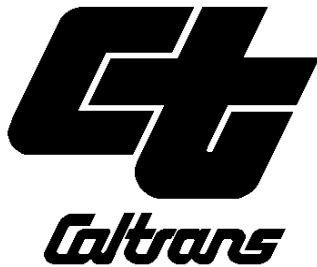


**** WARNING ** WARNING ** WARNING ** WARNING ****
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Note: Addenda information is NOT included with the electronic documents available via electronic file transfer. Only bidder or non-bidder package holders listed with the Caltrans Plans and Bid Documents section as described above will receive addenda information.



STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

NOTICE TO CONTRACTORS AND SPECIAL PROVISIONS

**FOR CONSTRUCTION ON STATE HIGHWAY IN
LOS ANGELES, GLENDALE AND LA CANADA FLINTRIDGE FROM ROUTE 2/5 SEPARATION
TO ROUTE 2/210 SEPARATION AND AT TRAFFIC MANAGEMENT CENTER**

DISTRICT 07, ROUTE 2

**For Use in Connection with Standard Specifications Dated JULY 1999, Standard Plans Dated JULY 1999, and Labor
Surcharge and Equipment Rental Rates.**

CONTRACT NO. 07-129944

07-LA-2-23.9/37.2

Federal Aid Project
ACNH-P002(028)E

Bids Open: July 12, 2001
Dated: June 4, 2001

OSD

IMPORTANT SPECIAL NOTICES

- The Special Provisions for Federal-aid projects (with and without DBE goals) have been revised to incorporate changes made by new regulations governing the DBE Program (49 CFR Part 26).

Sections 2 and 5 incorporate the changes. Bidders should read these sections to become familiar with them. Attention is directed to the following significant changes:

Section 2, "Disadvantaged Business Enterprise (DBE)" revises the counting of participation by DBE primes, and the counting of trucking performed by DBE firms. The section also revises the information that must be submitted to the Department in order to receive credit for trucking.

Section 2, "Submission of DBE Information" revises the information required to be submitted to the Department to receive credit toward the DBE goal. It also revises the criteria to demonstrate good faith efforts.

Section 5, "Subcontractor and DBE Records" revises the information required to be reported at the end of the project, and information related to trucking that must be submitted throughout the project.

Section 5, "DBE Certification Status" adds new reporting requirements related to DBE certification.

Section 5, "Subcontracting" describes the efforts that must be made in the event a DBE subcontractor is terminated or fails to complete its work for any reason.

Section 5, "Prompt Progress Payment to Subcontractors" requires prompt payment to all subcontractors.

Section 5, "Prompt Payment of Withheld Funds to Subcontractors" requires the prompt payment of retention to all subcontractors.

- **Payment Bonds**
Attention is directed to Section 5 of the Special Provisions, regarding contract bonds. The payment bond shall be in a sum not less than one hundred percent of the total amount payable by the terms of the contract.
- Attention is directed to Section 11-2, "Portland Cement Concrete," of these Special Provisions which contains Section 90, "Portland Cement Concrete," of the Standard Specifications.

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STANDARD PLANS LIST

The Standard Plan sheets applicable to this contract include, but are not limited to those indicated below. The Revised Standard Plans (RSP) and New Standard Plans (NSP) which apply to this contract are included as individual sheets of the project plans.

A10A	Abbreviations
A10B	Symbols
A73B	Markers
A77A	Metal Beam Guard Railing – Typical Wood Post With Wood Block
A77AA	Metal Beam Guard Railing – Typical Steel Post With Wood Block
A77B	Metal Beam Guard Railing - Standard Hardware
A77C	Metal Beam Guard Railing – Wood Post and Wood Block Details
A77F	Metal Beam Guard Railing – Typical Embankment Widening for End Treatments
A77FA	Metal Beam Guard Railing – Typical Line Post Installation
RSP A77G	Metal Beam Guard Railing – End Treatment, Terminal Anchor Assembly (Type SFT)
A77H	Metal Beam Guard Railing - Anchor Cable and Anchor Plate Details
A77IA	Metal Beam Guard Railing – End Treatment, Buried Post Anchor
A87	Curbs, Dikes and Driveways
H1	Planting and Irrigation - Abbreviations
H2	Planting and Irrigation - Symbols
T1A	Temporary Crash Cushion, Sand Filled (Unidirectional)
T1B	Temporary Crash Cushion, Sand Filled (Bidirectional)
RSP T2	Temporary Crash Cushion, Sand Filled (Shoulder Installations)
T3	Temporary Railing (Type K)
T7	Construction Project Funding Identification Signs
T10	Traffic Control System for Lane Closure On Freeways and Expressways
T11	Traffic Control System for Lane Closure On Multilane Conventional Highways
ES-1A	Signal, Lighting and Electrical Systems - Symbols and Abbreviations
ES-1B	Signal, Lighting and Electrical Systems - Symbols and Abbreviations
ES-2C	Signal, Lighting and Electrical Systems - Service Equipment Notes, Type III Series
ES-2E	Signal, Lighting and Electrical Systems - Service Equipment and Typical Wiring Diagram Type III-B Series
ES-3B	Signal, Lighting and Electrical Systems - Controller Cabinet Details
ES-3C	Signal, Lighting and Electrical Systems - Controller Cabinet Details
E S-5A	Signal, Lighting and Electrical Systems - Detectors
ES-5E	Signal, Lighting and Electrical Systems - Detectors
ES-7N	Signal and Lighting Standards - Details No. 2
ES-8	Signal, Lighting and Electrical Systems - Pull Box Details
ES-9A	Signal, Lighting and Electrical Systems - Electrical Details, Structure Installations
ES-9B	Signal, Lighting and Electrical Systems - Electrical Details, Structure Installations
ES-9C	Signal, Lighting and Electrical Systems - Electrical Details, Structure Installations
ES-9D	Signal, Lighting and Electrical Systems - Electrical Details, Structure Installations
ES-9E	Signal, Lighting and Electrical Systems - Electrical Details, Structure Installations
ES-13A	Signal, Lighting and Electrical Systems - Splicing Details
ES-16A	Closed Circuit Television Pole Details
ES-16B	Closed Circuit Television Pole Details - Overhead Sign Mounted

DEPARTMENT OF TRANSPORTATION

NOTICE TO CONTRACTORS

CONTRACT NO. 07-129944

07-LA-2-23.9/37.2

Sealed proposals for the work shown on the plans entitled:

**STATE OF CALIFORNIA; DEPARTMENT OF TRANSPORTATION; PROJECT PLANS FOR CONSTRUCTION
ON STATE HIGHWAY IN LOS ANGELES, GLENDALE AND LA CANADA FLINTRIDGE FROM ROUTE 2/5
SEPARATION TO ROUTE 2/210 SEPARATION AND AT TRAFFIC MANAGEMENT CENTER**

will be received at the Department of Transportation, 3347 Michelson Drive, Suite 100, Irvine, CA 92612-1692, until 2 o'clock p.m. on July 12, 2001, at which time they will be publicly opened and read in Room C - 1116 at the same address.

Proposal forms for this work are included in a separate book entitled:

**STATE OF CALIFORNIA; DEPARTMENT OF TRANSPORTATION; PROPOSAL AND CONTRACT FOR
CONSTRUCTION ON STATE HIGHWAY IN LOS ANGELES, GLENDALE AND LA CANADA
FLINTRIDGE FROM ROUTE 2/5 SEPARATION TO ROUTE 2/210 SEPARATION
AND AT TRAFFIC MANAGEMENT CENTER**

General work description: Communication system routing.

This project has a goal of 10 percent disadvantaged business enterprise (DBE) participation.

No prebid meeting is scheduled for this project.

**THIS PROJECT IS SUBJECT TO THE "BUY AMERICA" PROVISIONS OF THE SURFACE
TRANSPORTATION ASSISTANCE ACT OF 1982 AS AMENDED BY THE INTERMODAL SURFACE
TRANSPORTATION EFFICIENCY ACT OF 1991.**

Bids are required for the entire work described herein.

At the time this contract is awarded, the Contractor shall possess either a Class A license or one of the following Class C licenses: C-10.

This contract is subject to state contract nondiscrimination and compliance requirements pursuant to Government Code, Section 12990.

Project plans, special provisions, and proposal forms for bidding this project can only be obtained at the Department of Transportation, Plans and Bid Documents, Room 0200, MS #26, Transportation Building, 1120 N Street, Sacramento, California 95814, FAX No. (916) 654-7028, Telephone No. (916) 654-4490. Use FAX orders to expedite orders for project plans, special provisions and proposal forms. FAX orders must include credit card charge number, card expiration date and authorizing signature. Project plans, special provisions, and proposal forms may be seen at the above Department of Transportation office and at the offices of the District Directors of Transportation at Irvine, Oakland, and the district in which the work is situated. Standard Specifications and Standard Plans are available through the State of California, Department of Transportation, Publications Unit, 1900 Royal Oaks Drive, Sacramento, CA 95815, Telephone No. (916) 445-3520.

Cross sections for this project are not available.

The successful bidder shall furnish a payment bond and a performance bond.

The Department of Transportation hereby notifies all bidders that it will affirmatively insure that in any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full opportunity to submit bids in response to this invitation.

The U.S. Department of Transportation (DOT) provides a toll-free "hotline" service to report bid rigging activities. Bid rigging activities can be reported Mondays through Fridays, between 8:00 a.m. and 5:00 p.m., eastern time, Telephone No. 1-800-424-9071. Anyone with knowledge of possible bid rigging, bidder collusion, or other fraudulent activities should use the "hotline" to report these activities. The "hotline" is part of the DOT's continuing effort to identify and investigate highway construction contract fraud and abuse and is operated under the direction of the DOT Inspector General. All information will be treated confidentially and caller anonymity will be respected.

Pursuant to Section 1773 of the Labor Code, the general prevailing wage rates in the county, or counties, in which the work is to be done have been determined by the Director of the California Department of Industrial Relations. These wages are set forth in the General Prevailing Wage Rates for this project, available at the Labor Compliance Office at the offices of the District Director of Transportation for the district in which the work is situated, and available from the California Department of Industrial Relations' Internet Web Site at: <http://www.dir.ca.gov>. The Federal minimum wage rates for this project as predetermined by the United States Secretary of Labor are set forth in the books issued for bidding purposes entitled "Proposal and Contract," and in copies of this book that may be examined at the offices described above where project plans, special provisions, and proposal forms may be seen. Addenda to modify the Federal minimum wage rates, if necessary, will be issued to holders of "Proposal and Contract" books. Future effective general prevailing wage rates which have been predetermined and are on file with the California Department of Industrial Relations are referenced but not printed in the general prevailing wage rates.

Attention is directed to the Federal minimum wage rate requirements in the books entitled "Proposal and Contract." If there is a difference between the minimum wage rates predetermined by the Secretary of Labor and the general prevailing wage rates determined by the Director of the California Department of Industrial Relations for similar classifications of labor, the Contractor and subcontractors shall pay not less than the higher wage rate. The Department will not accept lower State wage rates not specifically included in the Federal minimum wage determinations. This includes "helper" (or other classifications based on hours of experience) or any other classification not appearing in the Federal wage determinations. Where Federal wage determinations do not contain the State wage rate determination otherwise available for use by the Contractor and subcontractors, the Contractor and subcontractors shall pay not less than the Federal minimum wage rate which most closely approximates the duties of the employees in question.

DEPARTMENT OF TRANSPORTATION

Deputy Director Transportation Engineering

Dated June 4, 2001

GLC

COPY OF ENGINEER'S ESTIMATE
(NOT TO BE USED FOR BIDDING PURPOSES)
07-129944

Item	Item Code	Item	Unit of Measure	Estimated Quantity
1	070012	PROGRESS SCHEDULE (CRITICAL PATH METHOD)	LS	LUMP SUM
2	070018	TIME-RELATED OVERHEAD	WDAY	300
3 (S)	120090	CONSTRUCTION AREA SIGNS	LS	LUMP SUM
4 (S)	120100	TRAFFIC CONTROL SYSTEM	LS	LUMP SUM
5	153531	ACCESS OPENING, SOFFIT	EA	4
6	190101	ROADWAY EXCAVATION	M3	210
7	190105	ROADWAY EXCAVATION (TYPE Z-2) (AERIALY DEPOSITED LEAD)	M3	1450
8	190110	LEAD COMPLIANCE PLAN	LS	LUMP SUM
9 (S)	208000	IRRIGATION SYSTEM	LS	LUMP SUM
10	390103	ASPHALT CONCRETE (TYPE B)	TONN	480
11	394040	PLACE ASPHALT CONCRETE DIKE (TYPE A)	M	48
12	394049	PLACE ASPHALT CONCRETE DIKE (TYPE F)	M	53
13	048525	STRUCTURAL CONCRETE, APPROACH SLAB (TYPE R MODIFIED)	M3	46
14 (S)	515074	CORE CONCRETE (101 MM - 150 MM)	M	47
15 (F)	560218	FURNISH SIGN STRUCTURE (TRUSS)	KG	9916
16 (S-F)	560219	INSTALL SIGN STRUCTURE (TRUSS)	KG	9916
17 (S)	561012	1220 MM CAST-IN-DRILLED-HOLE CONCRETE PILE (SIGN FOUNDATION)	EA	11
18	575005	TIMBER RETAINING WALL	M	6
19	832003	METAL BEAM GUARD RAILING (WOOD POST)	M	53
20 (S)	839553	END SECTION	EA	1

Item	Item Code	Item	Unit of Measure	Estimated Quantity
21 (S)	839568	TERMINAL ANCHOR ASSEMBLY (TYPE SFT)	EA	1
22	860520	HIGHWAY ADVISORY RADIO SYSTEM	LS	LUMP SUM
23	021469	HIGHWAY ADVISORY RADIO FLASHING BEACON AND SIGN (LOCATION 2)	LS	LUMP SUM
24	021470	HIGHWAY ADVISORY RADIO FLASHING BEACON AND SIGN (LOCATION 1)	LS	LUMP SUM
25	860767	SIZE 32 INNERDUCT	M	25 800
26	021471	103C (TRENCH IN SOIL)	M	5660
27	021472	103C (TRENCH IN ASPHALT)	M	5205
28	021473	103C (JACK BENEATH ROADWAY)	M	1800
29	021474	78C (JACK BENEATH ROADWAY)	M	160
30	021475	53C (TRENCH IN SOIL)	M	500
31	021476	53C (TRENCH IN ASPHALT)	M	120
32 (S-F)	860792	COMMUNICATION CONDUIT (BRIDGE)	M	2835
33	021520	TELEPHONE BRIDGE	EA	3
34	021477	TRAFFIC MONITORING STATION (LOCATION 2703)	LS	LUMP SUM
35	021478	TRAFFIC MONITORING STATION (LOCATION 1463)	LS	LUMP SUM
36	021479	TRAFFIC MONITORING STATION (LOCATION 2607)	LS	LUMP SUM
37	021480	TRAFFIC MONITORING STATION (LOCATION 2473)	LS	LUMP SUM
38	021481	TRAFFIC MONITORING STATION (LOCATION 1456)	LS	LUMP SUM
39	021482	TRAFFIC MONITORING STATION (LOCATION 2458)	LS	LUMP SUM
40	021483	TRAFFIC MONITORING STATION (LOCATION 1457)	LS	LUMP SUM

Item	Item Code	Item	Unit of Measure	Estimated Quantity
41	021484	TRAFFIC MONITORING STATION (LOCATION 1458)	LS	LUMP SUM
42	021485	TRAFFIC MONITORING STATION (LOCATION 2479)	LS	LUMP SUM
43	021486	TRAFFIC MONITORING STATION (LOCATION 1459)	LS	LUMP SUM
44	021487	TRAFFIC MONITORING STATION (LOCATION 1460)	LS	LUMP SUM
45	021488	TRAFFIC MONITORING STATION (LOCATION 2606)	LS	LUMP SUM
46	021489	TRAFFIC MONITORING STATION (LOCATION 2460)	LS	LUMP SUM
47	021490	TRAFFIC MONITORING STATION (LOCATION 1461)	LS	LUMP SUM
48	021491	CHANGEABLE MESSAGE SIGN 122 (LOCATION 1)	LS	LUMP SUM
49	021492	CHANGEABLE MESSAGE SIGN 121 (LOCATION 2)	LS	LUMP SUM
50	021493	CLOSED CIRCUIT TELEVISION CAMERA (LOCATION GL131)	LS	LUMP SUM
51	021494	CLOSED CIRCUIT TELEVISION CAMERA (LOCATION GL011)	LS	LUMP SUM
52	021495	CLOSED CIRCUIT TELEVISION CAMERA (LOCATION GL031)	LS	LUMP SUM
53	021496	CLOSED CIRCUIT TELEVISION CAMERA (LOCATION GL051)	LS	LUMP SUM
54	021497	CLOSED CIRCUIT TELEVISION CAMERA (LOCATION GL068)	LS	LUMP SUM
55	021498	CABLE NODE (LOCATION GL131)	LS	LUMP SUM
56	021499	MODIFY RAMP METERING SYSTEM (LOCATION 1467)	LS	LUMP SUM
57	021500	MODIFY RAMP METERING SYSTEM (LOCATION 1472)	LS	LUMP SUM
58	021501	MODIFY RAMP METERING SYSTEM (LOCATION 1815)	LS	LUMP SUM
59	867014	12 SINGLEMODE FIBER OPTIC CABLE	M	12 900
60	867021	72 SINGLEMODE FIBER OPTIC CABLE	M	13 000

Item	Item Code	Item	Unit of Measure	Estimated Quantity
61	867130	FIBER OPTIC SPLICE CLOSURE	EA	8
62	867135	TWISTED PAIR SPLICE CLOSURE	EA	25
63	051521	12 PAIR TERMINAL BLOCK	EA	3
64	021502	DETECTOR LOOP CABLE	M	200
65	021503	CABLE NODE	LS	LUMP SUM
66	869025	TWISTED PAIR CABLE (6 PAIR)	M	1500
67	869029	TWISTED PAIR CABLE (50 PAIR)	M	12 900
68	869035	NO. 5 PULL BOX	EA	7
69	869036	NO. 6 PULL BOX	EA	11
70	869039	COMMUNICATION PULL BOX	EA	66
71	869047	SPLICE VAULT	EA	5
72	021504	SYSTEM TESTING AND DOCUMENTATION	LS	LUMP SUM
73	999990	MOBILIZATION	LS	LUMP SUM

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISIONS

Annexed to Contract No. 07-129944

SECTION 1. SPECIFICATIONS AND PLANS

The work embraced herein shall conform to the provisions in the Standard Specifications dated July 1999, and the Standard Plans dated July 1999, of the Department of Transportation insofar as the same may apply, and these special provisions.

Amendments to the Standard Specifications set forth in these special provisions shall be considered as part of the Standard Specifications for the purposes set forth in Section 5-1.04, "Coordination and Interpretation of Plans, Standard Specifications and Special Provisions," of the Standard Specifications. Whenever either the term "Standard Specifications is amended" or the term "Standard Specifications are amended" is used in the special provisions, the indented text or table following the term shall be considered an amendment to the Standard Specifications. In case of conflict between such amendments and the Standard Specifications, the amendments shall take precedence over and be used in lieu of the conflicting portions.

In case of conflict between the Standard Specifications and these special provisions, the special provisions shall take precedence over and shall be used in lieu of the conflicting portions.

SECTION 2. PROPOSAL REQUIREMENTS AND CONDITIONS

2-1.01 GENERAL

The bidder's attention is directed to the provisions in Section 2, "Proposal Requirements and Conditions," of the Standard Specifications and these special provisions for the requirements and conditions which the bidder must observe in the preparation of the Proposal form and the submission of the bid.

In addition to the subcontractors required to be listed in conformance with Section 2-1.054, "Required Listing of Proposed Subcontractors," of the Standard Specifications, each proposal shall have listed therein the portion of work that will be performed by each subcontractor listed.

The Bidder's Bond form mentioned in the last paragraph in Section 2-1.07, "Proposal Guaranty," of the Standard Specifications will be found following the signature page of the Proposal.

Submit request for substitution of an "or equal" item, and the data substantiating the request to the Department of Transportation, Construction Division Chief, 120 S. Spring Street, Room 232, Los Angeles, CA 90012, so that the request is received by the Department by close of business on the fourth day, not including Saturdays, Sundays and legal holidays, following bid opening.

In conformance with Public Contract Code Section 7106, a Noncollusion Affidavit is included in the Proposal. Signing the Proposal shall also constitute signature of the Noncollusion Affidavit.

The contractor, sub recipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate. Each subcontract signed by the bidder must include this assurance.

2-1.015 FEDERAL LOBBYING RESTRICTIONS

Section 1352, Title 31, United States Code prohibits Federal funds from being expended by the recipient or any lower tier subrecipient of a Federal-aid contract to pay for any person for influencing or attempting to influence a Federal agency or Congress in connection with the awarding of any Federal-aid contract, the making of any Federal grant or loan, or the entering into of any cooperative agreement.

If any funds other than Federal funds have been paid for the same purposes in connection with this Federal-aid contract, the recipient shall submit an executed certification and, if required, submit a completed disclosure form as part of the bid documents.

A certification for Federal-aid contracts regarding payment of funds to lobby Congress or a Federal agency is included in the Proposal. Standard Form - LLL, "Disclosure of Lobbying Activities," with instructions for completion of the Standard Form is also included in the Proposal. Signing the Proposal shall constitute signature of the Certification.

The above-referenced certification and disclosure of lobbying activities shall be included in each subcontract and any lower-tier contracts exceeding \$100,000. All disclosure forms, but not certifications, shall be forwarded from tier to tier until received by the Engineer.

The Contractor, subcontractors and any lower-tier contractors shall file a disclosure form at the end of each calendar quarter in which there occurs any event that requires disclosure or that materially affects the accuracy of the information contained in any disclosure form previously filed by the Contractor, subcontractors and any lower-tier contractors. An event that materially affects the accuracy of the information reported includes:

- A. A cumulative increase of \$25,000 or more in the amount paid or expected to be paid for influencing or attempting to influence a covered Federal action; or
- B. A change in the person(s) or individual(s) influencing or attempting to influence a covered Federal action; or,
- C. A change in the officer(s), employee(s), or Member(s) contacted to influence or attempt to influence a covered Federal action.

2-1.02 DISADVANTAGED BUSINESS ENTERPRISE (DBE)

This project is subject to Part 26, Title 49, Code of Federal Regulations entitled "Participation by Disadvantaged Business Enterprises in Department of Transportation Financial Assistance Programs." The Regulations in their entirety are incorporated herein by this reference.

Bidders shall be fully informed respecting the requirements of the Regulations and the Department's Disadvantaged Business Enterprise (DBE) program developed pursuant to the Regulations; particular attention is directed to the following matters:

- A. A DBE must be a small business concern as defined pursuant to Section 3 of U.S. Small Business Act and relevant regulations promulgated pursuant thereto.
- B. A DBE may participate as a prime contractor, subcontractor, joint venture partner with a prime or subcontractor, vendor of material or supplies, or as a trucking company.
- C. A DBE bidder, not bidding as a joint venture with a non-DBE, will be required to document one or a combination of the following:
 - 1. The bidder will meet the goal by performing work with its own forces.
 - 2. The bidder will meet the goal through work performed by DBE subcontractors, suppliers or trucking companies.
 - 3. The bidder, prior to bidding, made adequate good faith efforts to meet the goal.
- D. A DBE joint venture partner must be responsible for specific contract items of work, or portions thereof. Responsibility means actually performing, managing and supervising the work with its own forces. The DBE joint venture partner must share in the capital contribution, control, management, risks and profits of the joint venture. The DBE joint venturer must submit the joint venture agreement with the proposal or the DBE Information form required in the Section entitled "Submission of DBE Information" of these special provisions.
- E. A DBE must perform a commercially useful function, i.e., must be responsible for the execution of a distinct element of the work and must carry out its responsibility by actually performing, managing and supervising the work.
- F. DBEs must be certified by either the California Department of Transportation, or by a participating State of California or local agency which certifies in conformance with Title 49, Code of Federal Regulations, Part 26, as of the date of bid opening. It is the Contractor's responsibility to verify that DBEs are certified. Listings of DBEs certified by the Department are available from the following sources:
 - 1. The Department's DBE Directory, which is published quarterly. This Directory may be obtained from the Department of Transportation, Materiel Operations Branch, Publication Distribution Unit, 1900 Royal Oaks Drive, Sacramento, California 95815, Telephone: (916) 445-3520.
 - 2. The Department's Electronic Information Bulletin Board Service, which is accessible by modem and is updated weekly. The Bulletin Board may be accessed by first contacting the Department's Business Enterprise Program at Telephone: (916) 227-8937 and obtaining a user identification and password.
 - 3. The Department's web site at <http://www.dot.ca.gov/hq/bep/index.htm>.
 - 4. The organizations listed in the Section entitled "DBE Goal for this Project" of these special provisions.

G. Credit for materials or supplies purchased from DBEs will be as follows:

1. If the materials or supplies are obtained from a DBE manufacturer, 100 percent of the cost of the materials or supplies will count toward the DBE goal. A DBE manufacturer is a firm that operates or maintains a factory or establishment that produces, on the premises, the materials, supplies, articles, or equipment required under the contract and of the general character described by the specifications.
2. If the materials or supplies are purchased from a DBE regular dealer, 60 percent of the cost of the materials or supplies will count toward the DBE goal. A DBE regular dealer is a firm that owns, operates, or maintains a store, warehouse, or other establishment in which the materials, supplies, articles or equipment of the general character described by the specifications and required under the contract are bought, kept in stock, and regularly sold or leased to the public in the usual course of business. To be a DBE regular dealer, the firm must be an established, regular business that engages, as its principal business and under its own name, in the purchase and sale or lease of the products in question. A person may be a DBE regular dealer in such bulk items as petroleum products, steel, cement, gravel, stone, or asphalt without owning, operating, or maintaining a place of business as provided in this paragraph G.2. if the person both owns and operates distribution equipment for the products. Any supplementing of regular dealers' own distribution equipment shall be by a long-term lease agreement and not on an ad hoc or contract-by-contract basis. Packagers, brokers, manufacturers' representatives, or other persons who arrange or expedite transactions are not DBE regular dealers within the meaning of this paragraph G.2.
3. Credit for materials or supplies purchased from a DBE which is neither a manufacturer nor a regular dealer will be limited to the entire amount of fees or commissions charged for assistance in the procurement of the materials and supplies, or fees or transportation charges for the delivery of materials or supplies required on a job site, provided the fees are reasonable and not excessive as compared with fees charged for similar services.

H. Credit for DBE trucking companies will be as follows:

1. The DBE must be responsible for the management and supervision of the entire trucking operation for which it is responsible on a particular contract, and there cannot be a contrived arrangement for the purpose of meeting the DBE goal.
2. The DBE must itself own and operate at least one fully licensed, insured, and operational truck used on the contract.
3. The DBE receives credit for the total value of the transportation services it provides on the contract using trucks it owns, insures, and operates using drivers it employs.
4. The DBE may lease trucks from another DBE firm, including an owner-operator who is certified as a DBE. The DBE who leases trucks from another DBE receives credit for the total value of the transportation services the lessee DBE provides on the contract.
5. The DBE may also lease trucks from a non-DBE firm, including an owner-operator. The DBE who leases trucks from a non-DBE is entitled to credit only for the fee or commission it receives as a result of the lease arrangement. The DBE does not receive credit for the total value of the transportation services provided by the lessee, since these services are not provided by a DBE.
6. For the purposes of this paragraph H, a lease must indicate that the DBE has exclusive use of and control over the truck. This does not preclude the leased truck from working for others during the term of the lease with the consent of the DBE, so long as the lease gives the DBE absolute priority for use of the leased truck. Leased trucks must display the name and identification number of the DBE.

I. Noncompliance by the Contractor with the requirements of the regulations constitutes a breach of this contract and may result in termination of the contract or other appropriate remedy for a breach of this contract.

J. Bidders are encouraged to use services offered by financial institutions owned and controlled by DBEs.

2-1.02A DBE GOAL FOR THIS PROJECT

The Department has established the following goal for Disadvantaged Business Enterprise (DBE) participation for this project:

Disadvantaged Business Enterprise (DBE): 10 percent

Bidders may use the services of the following firms to contact interested DBEs. These firms are available to assist DBEs in preparing bids for subcontracting or supplying materials.

The following firms may be contacted for projects in the following locations:

<p>Districts 04, 05 (except San Luis Obispo and Santa Barbara Counties), 06 (except Kern County) and 10:</p> <p>Triaxial Management Services, Inc. - Oakland</p> <p>1545 Willow Street, 1st Floor Oakland, CA 94607 Telephone - (510) 286-1313 FAX No. - (510) 286-6792</p>	<p>Districts 08, 11 and 12:</p> <p>Triaxial Management Services, Inc. - San Diego 2725 Congress Street, Suite 1-D San Diego, CA 92110 Telephone - (619) 543-5109 FAX No. - (619) 543-5108</p>
<p>Districts 07 and 08; in San Luis Obispo and Santa Barbara Counties in District 05; and in Kern County in District 06:</p> <p>Triaxial Management Services, Inc. - Los Angeles 2594 Industry Way, Suite 101 Lynwood, CA 90262 Telephone - (310) 537-6677 FAX No. - (310) 637-0128</p>	<p>Districts 01, 02, 03 and 09:</p> <p>Triaxial Management Services, Inc. - Sacramento 930 Alhambra Blvd., #205 Sacramento, CA 95816 Telephone - (916) 553-4172 FAX No. - (916) 553-4173</p>

2-1.02B SUBMISSION OF DBE INFORMATION

The required DBE information shall be submitted on the "CALTRANS BIDDER - DBE INFORMATION" form included in the Proposal. If the DBE information is not submitted with the bid, the DBE Information form shall be removed from the documents prior to submitting the bid.

It is the bidder's responsibility to make enough work available to DBEs and to select those portions of the work or material needs consistent with the available DBEs to meet the goal for DBE participation or to provide information to establish that, prior to bidding, the bidder made adequate good faith efforts to do so.

If DBE information is not submitted with the bid, the apparent successful bidder (low bidder), the second low bidder and the third low bidder shall submit DBE information to the Department of Transportation, 1120 N Street, Room 0200, MS #26, Sacramento, California 95814 so the information is received by the Department no later than 4:00 p.m. on the fourth day, not including Saturdays, Sundays and legal holidays, following bid opening. DBE information sent by U.S. Postal Service certified mail with return receipt and certificate of mailing and mailed on or before the third day, not including Saturdays, Sundays and legal holidays, following bid opening will be accepted even if it is received after the fourth day following bid opening. Failure to submit the required DBE information by the time specified will be grounds for finding the bid or proposal nonresponsive. Other bidders need not submit DBE information unless requested to do so by the Department.

The bidder's DBE information shall establish that good faith efforts to meet the DBE goal have been made. To establish good faith efforts, the bidder shall demonstrate that the goal will be met or that, prior to bidding, adequate good faith efforts to meet the goal were made.

Bidders are cautioned that even though their submittal indicates they will meet the stated DBE goal, their submittal should also include their adequate good faith efforts information along with their DBE goal information to protect their eligibility for award of the contract in the event the Department, in its review, finds that the goal has not been met.

The bidder's DBE information shall include the names, addresses and phone numbers of DBE firms that will participate, with a complete description of work or supplies to be provided by each, the dollar value of each DBE transaction, and a written confirmation from the DBE that it is participating in the contract. A copy of the DBE's quote will serve as written confirmation that the DBE is participating in the contract. When 100 percent of a contract item of work is not to be performed or furnished by a DBE, a description of the exact portion of that work to be performed or furnished by that DBE shall be included in the DBE information, including the planned location of that work. The work that a DBE prime contractor has committed to performing with its own forces as well as the work that it has committed to be performed by DBE subcontractors, suppliers and trucking companies will count toward the goal.

The information necessary to establish the bidder's adequate good faith efforts to meet the DBE goal should include:

- A. The names and dates of each publication in which a request for DBE participation for this project was placed by the bidder.
- B. The names and dates of written notices sent to certified DBEs soliciting bids for this project and the dates and methods used for following up initial solicitations to determine with certainty whether the DBEs were interested.
- C. The items of work which the bidder made available to DBE firms, including, where appropriate, any breaking down of the contract work items (including those items normally performed by the bidder with its own forces) into economically feasible units to facilitate DBE participation. It is the bidder's responsibility to demonstrate that sufficient work to meet the DBE goal was made available to DBE firms.
- D. The names, addresses and phone numbers of rejected DBE firms, the firms selected for that work, and the reasons for the bidder's choice.
- E. Efforts made to assist interested DBEs in obtaining bonding, lines of credit or insurance, and any technical assistance or information related to the plans, specifications and requirements for the work which was provided to DBEs.
- F. Efforts made to assist interested DBEs in obtaining necessary equipment, supplies, materials, or related assistance or services, excluding supplies and equipment the DBE subcontractor purchases or leases from the prime contractor or its affiliate.
- G. The names of agencies contacted to provide assistance in contacting, recruiting and using DBE firms.
- H. Any additional data to support a demonstration of good faith efforts.

SECTION 3. AWARD AND EXECUTION OF CONTRACT

The bidder's attention is directed to the provisions in Section 3, "Award and Execution of Contract," of the Standard Specifications and these special provisions for the requirements and conditions concerning award and execution of contract.

The award of the contract, if it be awarded, will be to the lowest responsible bidder whose proposal complies with all the requirements prescribed and who has met the goal for DBE participation or has demonstrated, to the satisfaction of the Department, adequate good faith efforts to do so. Meeting the goal for DBE participation or demonstrating, to the satisfaction of the Department, adequate good faith efforts to do so is a condition for being eligible for award of contract.

A "Payee Data Record" form will be included in the contract documents to be executed by the successful bidder. The purpose of the form is to facilitate the collection of taxpayer identification data. The form shall be completed and returned to the Department by the successful bidder with the executed contract and contract bonds. For the purposes of the form, payee shall be deemed to mean the successful bidder. The form is not to be completed for subcontractors or suppliers. Failure to complete and return the "Payee Data Record" form to the Department as provided herein will result in the retention of 31 percent of payments due the contractor and penalties of up to \$20,000. This retention of payments for failure to complete the "Payee Data Record" form is in addition to any other retention of payments due the Contractor.

SECTION 4. BEGINNING OF WORK, TIME OF COMPLETION AND LIQUIDATED DAMAGES

Attention is directed to the provisions in Section 8-1.03, "Beginning of Work," in Section 8-1.06, "Time of Completion," and in Section 8-1.07, "Liquidated Damages," of the Standard Specifications and these special provisions.

The Contractor shall begin work within 15 calendar days after the contract has been approved by the Attorney General or the attorney appointed and authorized to represent the Department of Transportation.

This work shall be diligently prosecuted to completion before the expiration of **300 WORKING DAYS** beginning on the fifteenth calendar day after approval of the contract.

The Contractor shall pay to the State of California the sum of \$650 per day, for each and every calendar day's delay in finishing the work in excess of the number of working days prescribed above.

SECTION 5. GENERAL

SECTION 5-1. MISCELLANEOUS

5-1.01 PLANS AND WORKING DRAWINGS

When the specifications require working drawings to be submitted to the Division of Structure Design, the drawings shall be submitted to: Division of Structure Design, Documents Unit, Mail Station 9, 1801 30th Street, Sacramento, CA 95816, Telephone 916 227-8252.

5-1.011 EXAMINATION OF PLANS, SPECIFICATIONS, CONTRACT, AND SITE OF WORK

The second paragraph of Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications is amended to read:

- Where the Department has made investigations of site conditions, including subsurface conditions in areas where work is to be performed under the contract, or in other areas, some of which may constitute possible local material sources, bidders or Contractors may, upon written request, inspect the records of the Department as to those investigations subject to and upon the conditions hereinafter set forth.

Attention is directed to "Differing Site Conditions" of these special provisions regarding physical conditions at the site which may differ from those indicated in "Materials Information," log of test borings or other geotechnical information obtained by the Department's investigation of site conditions.

5-1.012 DIFFERING SITE CONDITIONS

Attention is directed to Section 5-1.116, "Differing Site Conditions," of the Standard Specifications.

During the progress of the work, if subsurface or latent conditions are encountered at the site differing materially from those indicated in the "Materials Information," log of test borings, other geotechnical data obtained by the Department's investigation of subsurface conditions, or an examination of the conditions above ground at the site, the party discovering those conditions shall promptly notify the other party in writing of the specific differing conditions before they are disturbed and before the affected work is performed.

The Contractor will be allowed 15 days from the notification of the Engineer's determination of whether or not an adjustment of the contract is warranted, in which to file a notice of potential claim in conformance with the provisions of Section 9-1.04, "Notice of Potential Claim," of the Standard Specifications and as specified herein; otherwise the decision of the Engineer shall be deemed to have been accepted by the Contractor as correct. The notice of potential claim shall set forth in what respects the Contractor's position differs from the Engineer's determination and provide any additional information obtained by the Contractor, including but not limited to additional geotechnical data. The notice of potential claim shall be accompanied by the Contractor's certification that the following were made in preparation of the bid: a review of the contract, a review of the "Materials Information," a review of the log of test borings and other records of geotechnical data to the extent they were made available to bidders prior to the opening of bids, and an examination of the conditions above ground at the site. Supplementary information, obtained by the Contractor subsequent to the filing of the notice of potential claim, shall be submitted to the Engineer in an expeditious manner.

5-1.015 LABORATORY

When a reference is made in the specifications to the "Laboratory," the reference shall mean the Division of Materials Engineering and Testing Services and the Division of Structural Foundations of the Department of Transportation, or established laboratories of the various Districts of the Department, or other laboratories authorized by the Department to test materials and work involved in the contract. When a reference is made in the specifications to the "Transportation Laboratory," the reference shall mean the Division of Materials Engineering and Testing Services and the Division of Structural Foundations, located at 5900 Folsom Boulevard, Sacramento, CA 95819, Telephone (916) 227-7000.

5-1.017 CONTRACT BONDS

Attention is directed to Section 3-1.02, "Contract Bonds," of the Standard Specifications and these special provisions.

The payment bond shall be in a sum not less than one hundred percent of the total amount payable by the terms of the contract.

5-1.018 EXCAVATION SAFETY PLANS

Section 5-1.02A, "Trench Excavation Safety Plans," of the Standard Specifications is amended to read:

5-1.02A Excavation Safety Plans

- The Construction Safety Orders of the Division of Occupational Safety and Health shall apply to all excavations. For all excavations 1.5 m or more in depth, the Contractor shall submit to the Engineer a detailed plan showing the design and details of the protective systems to be provided for worker protection from the hazard of caving ground during excavation. The detailed plan shall include any tabulated data and any design calculations used in the preparation of the plan. Excavation shall not begin until the detailed plan has been reviewed and approved by the Engineer.

- Detailed plans of protective systems for which the Construction Safety Orders require design by a registered professional engineer shall be prepared and signed by an engineer who is registered as a Civil Engineer in the State of California, and shall include the soil classification, soil properties, soil design calculations that demonstrate adequate stability of the protective system, and any other design calculations used in the preparation of the plan.
- No plan shall allow the use of a protective system less effective than that required by the Construction Safety Orders.
- If the detailed plan includes designs of protective systems developed only from the allowable configurations and slopes, or Appendices, contained in the Construction Safety Orders, the plan shall be submitted at least 5 days before the Contractor intends to begin excavation. If the detailed plan includes designs of protective systems developed from tabulated data, or designs for which design by a registered professional engineer is required, the plan shall be submitted at least 3 weeks before the Contractor intends to begin excavation.
- Attention is directed to Section 7-1.01E, "Trench Safety."

The third paragraph of Section 19-1.02, "Preservation of Property," of the Standard Specifications is amended to read:

- In addition to the provisions in Sections 5-1.02, "Plans and Working Drawings," and 5-1.02A, "Excavation Safety Plans," detailed plans of the protective systems for excavations on or affecting railroad property will be reviewed for adequacy of protection provided for railroad facilities, property, and traffic. These plans shall be submitted at least 9 weeks before the Contractor intends to begin excavation requiring the protective systems. Approval by the Engineer of the detailed plans for the protective systems will be contingent upon the plans being satisfactory to the railroad company involved.

5-1.019 COST REDUCTION INCENTIVE

Attention is directed to Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications.

Prior to preparing a cost reduction proposal, the Contractor shall request a meeting with the Engineer to discuss the proposal in concept and to determine the merit of the cost reduction proposal. Items of discussion will also include permit issues, impact on other projects, impact on the project schedule, peer reviews, and review times required by the Department and other agencies.

5-1.02 LABOR NONDISCRIMINATION

Attention is directed to the following Notice that is required by Chapter 5 of Division 4 of Title 2, California Code of Regulations.

NOTICE OF REQUIREMENT FOR NONDISCRIMINATION PROGRAM

(GOV. CODE, SECTION 12990)

Your attention is called to the "Nondiscrimination Clause", set forth in Section 7-1.01A(4), "Labor Nondiscrimination," of the Standard Specifications, which is applicable to all nonexempt State contracts and subcontracts, and to the "Standard California Nondiscrimination Construction Contract Specifications" set forth therein. The specifications are applicable to all nonexempt State construction contracts and subcontracts of \$5000 or more.

5-1.03 INTEREST ON PAYMENTS

Interest shall be payable on progress payments, payments after acceptance, final payments, extra work payments, and claim payments as follows:

- A. Unpaid progress payments, payment after acceptance, and final payments shall begin to accrue interest 30 days after the Engineer prepares the payment estimate.
- B. Unpaid extra work bills shall begin to accrue interest 30 days after preparation of the first pay estimate following receipt of a properly submitted and undisputed extra work bill. To be properly submitted, the bill must be submitted within 7 days of the performance of the extra work and in conformance with the provisions in Section 9-1.03C, "Records," and Section 9-1.06, "Partial Payments," of the Standard Specifications. An undisputed extra work bill not submitted within 7 days of performance of the extra work will begin to accrue interest 30 days after the preparation of the second pay estimate following submittal of the bill.
- C. The rate of interest payable for unpaid progress payments, payments after acceptance, final payments, and extra work payments shall be 10 percent per annum.

- D. The rate of interest payable on a claim, protest or dispute ultimately allowed under this contract shall be 6 percent per annum. Interest shall begin to accrue 61 days after the Contractor submits to the Engineer information in sufficient detail to enable the Engineer to ascertain the basis and amount of said claim, protest or dispute.

The rate of interest payable on any award in arbitration shall be 6 percent per annum if allowed under the provisions of Civil Code Section 3289.

5-1.031 FINAL PAYMENT AND CLAIMS

Attention is directed to Section 9-1.07B, "Final Payment and Claims," of the Standard Specifications.

If the Contractor files a timely written statement of claims in response to the proposed final estimate, the District that administers the contract will submit a claim position letter to the Contractor by hand delivery or deposit in the U.S. mail within 135 days of acceptance of the contract. The claim position letter will delineate the District's position on the Contractor's claims. If the Contractor disagrees with the claim position letter, the Contractor shall submit a written notification of its disagreement to be received by the District not later than 15 days after the Contractor's receipt of the claim position letter. The written notification of disagreement shall set forth the basis for the Contractor's disagreement and be submitted to the office designated in the claim position letter. The Contractor's failure to provide a timely, written notification of disagreement shall constitute the Contractor's acceptance and agreement with the determinations provided in the claim position letter and with final payment pursuant to the claim position letter.

If the Contractor files a timely notification of disagreement with the District claim position letter, the board of review designated by the District Director to review claims that remain in dispute will meet with the Contractor within 45 days after receipt by the District of the notification of disagreement. Attendance by the Contractor at the board of review meeting shall be mandatory.

If the District fails to submit a claim position letter to the Contractor within 135 days after the acceptance of the contract and the Contractor has claims that remain in dispute, the Contractor may request a meeting with the board of review designated by the District Director to review claims that remain in dispute. The Contractor's request for a meeting shall identify the claims that remain in dispute. If the Contractor files a request for a meeting, the board of review will meet with the Contractor within 45 days after the District receives the request for the meeting. Attendance by the Contractor at the District Director's board of review meeting shall be mandatory.

Failure of the Contractor to file a timely written statement of claims in response to the proposed final estimate, or to file a timely notification of disagreement with the District claim position letter, or to attend the District Director's board of review meeting shall constitute a failure to pursue diligently and exhaust the administrative procedures in the contract and shall be a bar to arbitration in conformance with the requirements in Section 10240.2 of the California Public Contract Code.

5-1.04 PUBLIC SAFETY

The Contractor shall provide for the safety of traffic and the public in conformance with the provisions in Section 7-1.09, "Public Safety," of the Standard Specifications and these special provisions.

The Contractor shall install temporary railing (Type K) between a lane open to public traffic and an excavation, obstacle or storage area when the following conditions exist:

- A. Excavations.—The near edge of the excavation is 3.6 m or less from the edge of the lane, except:
 - 1. Excavations covered with sheet steel or concrete covers of adequate thickness to prevent accidental entry by traffic or the public.
 - 2. Excavations less than 0.3-m deep.
 - 3. Trenches less than 0.3-m wide for irrigation pipe or electrical conduit, or excavations less than 0.3-m in diameter.
 - 4. Excavations parallel to the lane for the purpose of pavement widening or reconstruction.
 - 5. Excavations in side slopes, where the slope is steeper than 1:4 (vertical:horizontal).
 - 6. Excavations protected by existing barrier or railing.
- B. Temporarily Unprotected Permanent Obstacles.—The work includes the installation of a fixed obstacle together with a protective system, such as a sign structure together with protective railing, and the Contractor elects to install the obstacle prior to installing the protective system; or the Contractor, for the Contractor's convenience and with permission of the Engineer, removes a portion of an existing protective railing at an obstacle and does not replace such railing complete in place during the same day.
- C. Storage Areas.—Material or equipment is stored within 3.6 m of the lane and the storage is not otherwise prohibited by the provisions of the Standard Specifications and these special provisions.

The approach end of temporary railing (Type K), installed in conformance with the provisions in this section "Public Safety" and in Section 7-1.09, "Public Safety," of the Standard Specifications, shall be offset a minimum of 4.6 m from the edge of the traffic lane open to public traffic. The temporary railing shall be installed on a skew toward the edge of the traffic lane of not more than 0.3-m transversely to 3 m longitudinally with respect to the edge of the traffic lane. If the 4.6-m minimum offset cannot be achieved, the temporary railing shall be installed on the 10 to 1 skew to obtain the maximum available offset between the approach end of the railing and the edge of the traffic lane, and an array of temporary crash cushion modules shall be installed at the approach end of the temporary railing.

Temporary railing (Type K) shall conform to the provisions in Section 12-3.08, "Temporary Railing (Type K)," of the Standard Specifications. Temporary railing (Type K), conforming to the details shown on 1999 Standard Plan T3, may be used. Temporary railing (Type K) fabricated prior to January 1, 1993, and conforming to 1988 Standard Plan B11-30 may be used, provided the fabrication date is printed on the required Certificate of Compliance.

Temporary crash cushion modules shall conform to the provisions in "Temporary Crash Cushion Module" of these special provisions.

Except for installing, maintaining and removing traffic control devices, whenever work is performed or equipment is operated in the following work areas, the Contractor shall close the adjacent traffic lane unless otherwise provided in the Standard Specifications and these special provisions:

Approach Speed of Public Traffic (Posted Limit) (Kilometers Per Hour)	Work Areas
Over 72 (45 Miles Per Hour)	Within 1.8 m of a traffic lane but not on a traffic lane
56 to 72 (35 to 45 Miles Per Hour)	Within 0.9-m of a traffic lane but not on a traffic lane

The lane closure provisions of this section shall not apply if the work area is protected by permanent or temporary railing or barrier.

When traffic cones or delineators are used to delineate a temporary edge of a traffic lane, the line of cones or delineators shall be considered to be the edge of the traffic lane, however, the Contractor shall not reduce the width of an existing lane to less than 3 m without written approval from the Engineer.

When work is not in progress on a trench or other excavation that required closure of an adjacent lane, the traffic cones or portable delineators used for the lane closure shall be placed off of and adjacent to the edge of the traveled way. The spacing of the cones or delineators shall be not more than the spacing used for the lane closure.

Suspended loads or equipment shall not be moved nor positioned over public traffic or pedestrians.

Full compensation for conforming to the provisions in this section "Public Safety," including furnishing and installing temporary railing (Type K) and temporary crash cushion modules, shall be considered as included in the contract prices paid for the various items of work involved and no additional compensation will be allowed therefor.

5-1.05 SURFACE MINING AND RECLAMATION ACT

Attention is directed to the Surface Mining and Reclamation Act of 1975, commencing in Public Resources Code, Mining and Geology, Section 2710, which establishes regulations pertinent to surface mining operations, and to California Public Contract Code Section 10295.5.

Material from mining operations furnished for this project shall only come from permitted sites in compliance with California Public Contract Code Section 10295.5.

The requirements of this section shall apply to materials furnished for the project, except for acquisition of materials in conformance with the provisions in Section 4-1.05, "Use of Materials Found on the Work," of the Standard Specifications.

5-1.06 REMOVAL OF ASBESTOS AND HAZARDOUS SUBSTANCES

When the presence of asbestos or hazardous substances are not shown on the plans or indicated in the specifications and the Contractor encounters materials which the Contractor reasonably believes to be asbestos or a hazardous substance as defined in Section 25914.1 of the Health and Safety Code, and the asbestos or hazardous substance has not been rendered harmless, the Contractor may continue work in unaffected areas reasonably believed to be safe. The Contractor shall immediately cease work in the affected area and report the condition to the Engineer in writing.

In conformance with Section 25914.1 of the Health and Safety Code, removal of asbestos or hazardous substances including exploratory work to identify and determine the extent of the asbestos or hazardous substance will be performed by separate contract.

If delay of work in the area delays the current controlling operation, the delay will be considered a right of way delay and the Contractor will be compensated for the delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

5-1.07 YEAR 2000 COMPLIANCE

This contract is subject to Year 2000 Compliance for automated devices in the State of California.

Year 2000 compliance for automated devices in the State of California is achieved when embedded functions have or create no logical or mathematical inconsistencies when dealing with dates prior to and beyond 1999. The year 2000 is recognized and processed as a leap year. The product shall operate accurately in the manner in which the product was intended for date operation without requiring manual intervention.

The Contractor shall provide the Engineer a Certificate of Compliance from the manufacturer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for all automated devices furnished for the project.

5-1.075 BUY AMERICA REQUIREMENTS

Attention is directed to the "Buy America" requirements of the Surface Transportation Assistance Act of 1982 (Section 165) and the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) Sections 1041(a) and 1048(a), and the regulations adopted pursuant thereto. In conformance with the law and regulations, all manufacturing processes for steel and iron materials furnished for incorporation into the work on this project shall occur in the United States; with the exception that pig iron and processed, pelletized and reduced iron ore manufactured outside of the United States may be used in the domestic manufacturing process for such steel and iron materials. The application of coatings, such as epoxy coating, galvanizing, painting, and other coatings that protect or enhance the value of steel or iron materials shall be considered a manufacturing process subject to the "Buy America" requirements.

A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications shall be furnished for steel and iron materials. The certificates, in addition to certifying that the materials comply with the specifications, shall specifically certify that all manufacturing processes for the materials occurred in the United States, except for the above exceptions.

The requirements imposed by the law and regulations do not prevent a minimal use of foreign steel and iron materials if the total combined cost of the materials used does not exceed one-tenth of one percent (0.1 percent) of the total contract cost or \$2500, whichever is greater. The Contractor shall furnish the Engineer acceptable documentation of the quantity and value of the foreign steel and iron prior to incorporating the materials into the work.

5-1.08 SUBCONTRACTOR AND DBE RECORDS

The Contractor shall maintain records showing the name and business address of each first-tier subcontractor. The records shall also show the name and business address of every DBE subcontractor, DBE vendor of materials and DBE trucking company, regardless of tier. The records shall show the date of payment and the total dollar figure paid to all of these firms. DBE prime contractors shall also show the date of work performed by their own forces along with the corresponding dollar value of the work.

Upon completion of the contract, a summary of these records shall be prepared on Form CEM-2402 (F) and certified correct by the Contractor or the Contractor's authorized representative, and shall be furnished to the Engineer. The form shall be furnished to the Engineer within 90 days from the date of contract acceptance. \$10,000 will be withheld from payment until the Form CEM-2402 (F) is submitted. The amount will be returned to the Contractor when a satisfactory Form CEM-2402 (F) is submitted.

Prior to the fifteenth of each month, the Contractor shall submit documentation to the Engineer showing the amount paid to DBE trucking companies listed in the Contractor's DBE information. This monthly documentation shall indicate the portion of the revenue paid to DBE trucking companies which is claimed toward DBE participation. The Contractor shall also obtain and submit documentation to the Engineer showing the amount paid by DBE trucking companies to all firms, including owner-operators, for the leasing of trucks. The DBE who leases trucks from a non-DBE is entitled to credit only for the fee or commission it receives as a result of the lease arrangement. The records must confirm that the amount of credit claimed toward DBE participation conforms with Section 2-1.02, "Disadvantaged Business Enterprise," of these special provisions.

The Contractor shall also obtain and submit documentation to the Engineer showing the truck number, owner's name, California Highway Patrol CA number, and if applicable, the DBE certification number of the owner of the truck for all trucks used during that month for which DBE participation will be claimed. This documentation shall be submitted on Form CEM-2404 (F).

5-1.083 DBE CERTIFICATION STATUS

If a DBE subcontractor is decertified during the life of the project, the decertified subcontractor shall notify the Contractor in writing with the date of decertification. If a subcontractor becomes a certified DBE during the life of the project, the subcontractor shall notify the Contractor in writing with the date of certification. The Contractor shall furnish the written documentation to the Engineer.

Upon completion of the contract, Form CEM-2403 (F) indicating the DBE's existing certification status shall be signed and certified correct by the Contractor. The certified form shall be furnished to the Engineer within 90 days from the date of contract acceptance.

5-1.086 PERFORMANCE OF DBE SUBCONTRACTORS AND SUPPLIERS

The DBEs listed by the Contractor in response to the provisions in Section 2-1.02B, "Submission of DBE Information," and Section 3, "Award and Execution of Contract," of these special provisions, which are determined by the Department to be certified DBEs, shall perform the work and supply the materials for which they are listed, unless the Contractor has received prior written authorization to perform the work with other forces or to obtain the materials from other sources.

Authorization to use other forces or sources of materials may be requested for the following reasons:

- A. The listed DBE, after having had a reasonable opportunity to do so, fails or refuses to execute a written contract, when such written contract, based upon the general terms, conditions, plans and specifications for the project, or on the terms of such subcontractor's or supplier's written bid, is presented by the Contractor.
- B. The listed DBE becomes bankrupt or insolvent.
- C. The listed DBE fails or refuses to perform the subcontract or furnish the listed materials.
- D. The Contractor stipulated that a bond was a condition of executing a subcontract and the listed DBE subcontractor fails or refuses to meet the bond requirements of the Contractor.
- E. The work performed by the listed subcontractor is substantially unsatisfactory and is not in substantial conformance with the plans and specifications, or the subcontractor is substantially delaying or disrupting the progress of the work.
- F. It would be in the best interest of the State.

The Contractor shall not be entitled to any payment for such work or material unless it is performed or supplied by the listed DBE or by other forces (including those of the Contractor) pursuant to prior written authorization of the Engineer.

5-1.09 SUBCONTRACTING

Attention is directed to the provisions in Section 8-1.01, "Subcontracting," of the Standard Specifications, and Section 2, "Proposal Requirements and Conditions," and Section 3, "Award and Execution of Contract," of these special provisions.

Pursuant to the provisions of Section 1777.1 of the Labor Code, the Labor Commissioner publishes and distributes a list of contractors ineligible to perform work as a subcontractor on a public works project. This list of debarred contractors is available from the Department of Industrial Relations web site at:

<http://www.dir.ca.gov/DLSE/Debar.html>.

The provisions in the third paragraph of Section 8-1.01, "Subcontracting," of the Standard Specifications, that the Contractor shall perform with the Contractor's own organization contract work amounting to not less than 50 percent of the original contract price, is not changed by the Federal Aid requirement specified under "Required Contract Provisions Federal-Aid Construction Contracts" in Section 14 of these special provisions that the Contractor perform not less than 30 percent of the original contract work with the Contractor's own organization.

Each subcontract and any lower tier subcontract that may in turn be made shall include the "Required Contract Provisions Federal-Aid Construction Contracts" in Section 14 of these special provisions. This requirement shall be enforced as follows:

- A. Noncompliance shall be corrected. Payment for subcontracted work involved will be withheld from progress payments due, or to become due, until correction is made. Failure to comply may result in termination of the contract.

In conformance with the Federal DBE regulations Sections 26.53(f)(1) and 26.53(f)(2) Part 26, Title 49 CFR:

- A. The Contractor shall not terminate for convenience a DBE subcontractor listed in response to Section 2-1.02B, "Submission of DBE Information," and then perform that work with its own forces, or those of an affiliate without the written consent of the Department, and
- B. If a DBE subcontractor is terminated or fails to complete its work for any reason, the Contractor will be required to make good faith efforts to substitute another DBE subcontractor for the original DBE subcontractor, to the extent needed to meet the contract goal.

The requirement in Section 2-1.02, "Disadvantaged Business Enterprise (DBE)," of these special provisions that DBEs must be certified on the date bids are opened does not apply to DBE substitutions after award of the contract.

5-1.10 PROMPT PROGRESS PAYMENT TO SUBCONTRACTORS

Attention is directed to the provisions in Sections 10262 and 10262.5 of the Public Contract Code and Section 7108.5 of the Business and Professions Code concerning prompt payment to subcontractors.

5-1.102 PROMPT PAYMENT OF WITHHELD FUNDS TO SUBCONTRACTORS

The Contractor shall return all moneys withheld in retention from the subcontractor within 30 days after receiving payment for work satisfactorily completed, even if the other contract work is not completed and has not been accepted in conformance with Section 7-1.17, "Acceptance of Contract," of the Standard Specifications. This requirement shall not be construed to limit or impair any contractual, administrative, or judicial remedies otherwise available to the Contractor or subcontractor in the event of a dispute involving late payment or nonpayment by the Contractor or deficient subcontract performance or noncompliance by a subcontractor.

5-1.11 PARTNERING

The State will promote the formation of a "Partnering" relationship with the Contractor in order to effectively complete the contract to the benefit of both parties. The purpose of this relationship is to maintain a cooperative communication and to mutually resolve conflicts at the lowest responsible management level.

The Contractor may request the formation of a "Partnering" relationship by submitting a request in writing to the Engineer after approval of the contract. If the Contractor's request for "Partnering" is approved by the Engineer, scheduling of a "Partnering Workshop," selecting the "Partnering" facilitator and workshop site, and other administrative details shall be as agreed to by both parties. If agreed to by the parties, additional "Partnering Workshops" will be conducted as needed throughout the life of the contract.

The costs involved in providing the "Partnering Workshop" facilitator and workshop site will be borne equally by the State and the Contractor. The division of cost will be made by determining the cost in providing the "Partnering Workshop" facilitator and workshop site in conformance with the provisions in Section 9-1.03B, "Work Performed by Special Forces or Other Special Services," of the Standard Specifications, and paying to the Contractor one-half of that cost, except no markups will be allowed.

All other costs associated with "Partnering Workshops" will be borne separately by the party incurring the costs, such as wages and travel expenses, and no additional compensation will be allowed therefor.

The establishment of a "Partnering" relationship will not change or modify the terms and conditions of the contract and will not relieve either party of the legal requirements of the contract.

5-1.114 VALUE ANALYSIS

The Contractor may submit to the Engineer, in writing, a request for a "Value Analysis" workshop. The purpose for having a workshop is to identify value enhancing opportunities and to consider modifications to the plans and specifications that will reduce either the total cost, time of construction or traffic congestion, without impairing, in any manner, the essential functions or characteristics of the project including, but not limited to, service life, economy of operation, ease of maintenance, benefits to the travelling public, desired appearance, or design and safety standards.

To maximize the potential benefits of a workshop, the request should be submitted to the Engineer early in the project after approval of the contract. If the Contractor's request for a "Value Analysis" workshop is approved by the Engineer, scheduling of a workshop, selecting the facilitator and workshop site, and other administrative details shall be determined cooperatively by the Contractor and the Engineer.

The workshop shall be conducted in conformance with the methodology described in the Department's "Value Analysis Team Guide" available at the Department's web site at:

<http://www.dot.ca.gov/hq/oppd/value/>

The facilitator shall be a Certified Value Specialist (CVS) as recognized by the Society of American Value Engineers (SAVE) International, which may be contacted as follows:

SAVE International, 60 Revere Drive, Northbrook, IL 60062
Telephone 1-847-480-1730, FAX 1-847-480-9282

The Contractor may submit recommendations resulting from a "Value Analysis" workshop for approval by the Engineer as cost reduction incentive proposals in conformance with the provisions in Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications.

The costs involved in providing the "Value Analysis" facilitator and workshop site will be borne equally by the State and the Contractor. The division of cost will be made by determining the cost in providing the "Value Analysis" facilitator and workshop site in conformance with the provisions in Section 9-1.03B, "Work Performed by Special Forces or Other Special Services," of the Standard Specifications, and paying to the Contractor one-half of that cost, except no markups will be allowed.

All other costs associated with the "Value Analysis" workshop will be borne separately by the party incurring the costs, such as wages and travel expenses, and no additional compensation will be allowed therefor.

5-1.12 FORCE ACCOUNT PAYMENT

The second, third and fourth paragraphs of Section 9-1.03A, "Work Performed by Contractor," in the Standard Specifications, shall not apply.

Attention is directed to "Overhead" of these special provisions.

To the total of the direct costs for work performed on a force account basis, computed as provided in Sections 9-1.03A(1), "Labor," 9-1.03A(2), "Materials," and 9-1.03A(3), "Equipment Rental," of the Standard Specifications, there will be added the following markups:

Cost	Percent Markup
Labor	28
Materials	10
Equipment Rental	10

The above markups shall be applied to all work performed on a force account basis, regardless of whether the work revises the current contract completion date.

The above markups, together with payments made for time-related overhead pursuant to "Overhead" of these special provisions, shall constitute full compensation for all overhead costs for work performed on a force account basis. These overhead costs shall be deemed to include all items of expense not specifically designated as cost or equipment rental in conformance with the provisions in Sections 9-1.03A(1), "Labor," 9-1.03A(2), "Materials," and 9-1.03A(3), "Equipment Rental," of the Standard Specifications. The total payment made as provided above and in the first paragraph of Section 9-1.03A, "Work Performed by Contractor," of the Standard Specifications shall be deemed to be the actual cost of the work performed on a force account basis, and shall constitute full compensation therefor. Full compensation for all overhead costs for work performed on a force account basis, and for which no adjustment is made to the quantity of time-related overhead pursuant to "Overhead" of these special provisions, shall be considered as included in the markups specified above, and no additional compensation will be allowed therefor.

When extra work to be paid for on a force account basis is performed by a subcontractor, approved in conformance with the provisions in Section 8-1.01, "Subcontracting," of the Standard Specifications, an additional markup of 7 percent will be added to the total cost of that extra work including all markups specified in this section "Force Account Payment". The additional 7 percent markup shall reimburse the Contractor for additional administrative costs, and no other additional payment will be made by reason of performance of the extra work by a subcontractor.

5-1.13 AREAS FOR CONTRACTOR'S USE

Attention is directed to the provisions in Section 7-1.19, "Rights in Land and Improvements," of the Standard Specifications and these special provisions.

The highway right of way shall be used only for purposes that are necessary to perform the required work. The Contractor shall not occupy the right of way, or allow others to occupy the right of way, for purposes which are not necessary to perform the required work.

No State-owned parcels adjacent to the right of way are available for the exclusive use of the Contractor within the contract limits. The Contractor shall secure, at the Contractor's own expense, areas required for plant sites, storage of equipment or materials, or for other purposes.

No area is available within the contract limits for the exclusive use of the Contractor. However, temporary storage of equipment and materials on State property may be arranged with the Engineer, subject to the prior demands of State maintenance forces and to other contract requirements. Use of the Contractor's work areas and other State-owned property shall be at the Contractor's own risk, and the State shall not be held liable for damage to or loss of materials or equipment located within such areas.

5-1.14 PAYMENTS

Attention is directed to Sections 9-1.06, "Partial Payments," and 9-1.07, "Payment After Acceptance," of the Standard Specifications and these special provisions.

For the purpose of making partial payments pursuant to Section 9-1.06, "Partial Payments," of the Standard Specifications, the amount set forth for the contract items of work hereinafter listed shall be deemed to be the maximum value of the contract item of work which will be recognized for progress payment purposes:

- A. Progress Schedule (Critical Path Method) \$65,000.00

In determining the partial payments to be made to the Contractor, only the following listed materials will be considered for inclusion in the payment as materials furnished but not incorporated in the work:

- A. Pipe Irrigation System
- B. Railings and Appurtenances
- C. Camera Poles
- D. Fiber Optic Cables
- E. Splice Vaults
- F. Camera Control Receivers
- G. Single Fiber Optic Video Transceivers
- H. CCTV Cameras

5-1.15 SOUND CONTROL REQUIREMENTS

Sound control shall conform to the provisions in Section 7-1.01I, "Sound Control Requirements," of the Standard Specifications and these special provisions.

The noise level from the Contractor's operations, between the hours of 9:00 p.m. and 7:00 a.m., shall not exceed 86 dbA at a distance of 15 m. This requirement shall not relieve the Contractor from responsibility for complying with local ordinances regulating noise level.

The noise level requirement shall apply to the equipment on the job or related to the job, including but not limited to trucks, transit mixers or transient equipment that may or may not be owned by the Contractor. The use of loud sound signals shall be avoided in favor of light warnings except those required by safety laws for the protection of personnel.

Full compensation for conforming to the requirements of this section shall be considered as included in the prices paid for the various contract items of work involved and no additional compensation will be allowed therefor.

5-1.16 RELATIONS WITH ARMY CORPS OF ENGINEERS

The location of the Los Angeles River Undercrossing is within an area controlled by the Army Corps of Engineers. The Army Corps of Engineers memo is included in the "Material Information Handout." The Contractor shall be fully informed of the conditions that may govern the Contractor's operations in the areas and shall conduct the work accordingly.

Attention is directed to Section 7-1.11, "Preservation of Property," and Section 7-1.12, "Indemnification and Insurance," of the Standard Specifications.

The Contractor's attention is directed to the following conditions which are among those established by the Army Corps of Engineers for this project:

- A. Between October 15 to April 15, work within the Los Angeles River Channel shall not be allowed unless there is a five-day clear weather forecast.

Changes in the above listed conditions proposed by the Contractor shall be submitted to the Engineer for transmittal to the Army Corps of Engineers for their approval. Changes shall not be implemented until approved in writing by the Army Corps of Engineers.

Attention is directed to Section 8-1.06, "Time of Completion," of the Standard Specifications. Days when the Contractor's operations are restricted by the requirements of this section shall not be considered to be nonworking days whether or not the controlling operation is delayed.

5-1.17 AERIALY DEPOSITED LEAD

Aerially deposited lead is present within the project limits. Aerially deposited lead is lead deposited within unpaved areas or formerly unpaved areas, primarily due to vehicle emissions.

Attention is directed to "Material Containing Aerially Deposited Lead" of these special provisions.

Portions of the Site Investigation Report are included in the "Material Information Handout." The complete report, entitled "Aerially Deposited Lead Site Investigation Report, Glendale Freeway (Route 2) Between Route 210 and Interstate 5 (LA-2-KP 23.9/37.2), Glendale, California," is available for inspection at the Department of Transportation, Construction Office, Room 244, 120 South Spring Street, Los Angeles, California 90012, Telephone: (213) 897-0054.

Once the Contractor has completed the placement of material containing aerially deposited lead in conformance with these special provisions and as directed by the Engineer, the Contractor shall have no responsibility for such materials in place. The Department will not consider the Contractor a generator of such contaminated materials. Further cleanup, removal or remedial actions for such materials will not be required if handled or disposed of as specified herein.

Excavation, reuse, and disposal of material with aerially deposited lead shall be in conformance with all rules and regulations including, but not limited to, those of the following agencies:

United States Department of Transportation (USDOT)
United States Environmental Protection Agency (USEPA)
California Environmental Protection Agency (Cal-EPA)
California Department of Health Services
Department of Toxic Substances Control (DTSC), Region 3
California Division of Occupational Safety and Health Administration (Cal-OSHA)
Integrated Waste Management Board
Regional Water Quality Control Board (RWQCB), Region 4
State Air Resources Control Board
South Coast Air Quality Management District (AQMD)

Materials containing hazardous levels of lead shall be transported and disposed of in conformance with Federal and State laws and regulations, as amended, and county and municipal ordinances and regulations, as amended. Laws and regulations that govern this work include, but are not limited to:

Health and Safety Code, Division 20, Chapter 6.5 (California Hazardous Waste Control Act)
Title 22, California Code of Regulations, Division 4.5 (Environmental Health Standards for the Management of Hazardous Waste)
Title 8, California Code of Regulations

SECTION 6. (BLANK)

SECTION 7. (BLANK)

SECTION 8. MATERIALS

SECTION 8-1. MISCELLANEOUS

8-1.01 SUBSTITUTION OF NON-METRIC MATERIALS AND PRODUCTS

Only materials and products conforming to the requirements of the specifications shall be incorporated in the work. When metric materials and products are not available, and when approved by the Engineer, and at no cost to the State, materials and products in the United States Standard Measures which are of equal quality and of the required properties and characteristics for the purpose intended, may be substituted for the equivalent metric materials and products, subject to the following provisions:

- A. Materials and products shown on the plans or in the special provisions as being equivalent may be substituted for the metric materials and products specified or detailed on the plans.
- B. Before other non-metric materials and products will be considered for use, the Contractor shall furnish, at the Contractor's expense, evidence satisfactory to the Engineer that the materials and products proposed for use are equal to or better than the materials and products specified or detailed on the plans. The burden of proof as to the quality and suitability of substitutions shall be upon the Contractor and the Contractor shall furnish necessary information as required by the Engineer. The Engineer will be the sole judge as to the quality and suitability of the substituted materials and products and the Engineer's decision will be final.
- C. When the Contractor elects to substitute non-metric materials and products, including materials and products shown on the plans or in the special provisions as being equivalent, the list of sources of material specified in Section 6-1.01, "Source of Supply and Quality of Materials," of the Standard Specification shall include a list of substitutions to be made and contract items involved. In addition, for a change in design or details, the Contractor shall submit plans and working drawings in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The plans and working drawings shall be submitted at least 7 days before the Contractor intends to begin the work involved.

Unless otherwise specified, the following substitutions of materials and products will be allowed:

SUBSTITUTION TABLE FOR SIZES OF HIGH STRENGTH STEEL FASTENERS

ASTM Designation: A 325M

METRIC SIZE SHOWN ON THE PLANS mm x thread pitch	SIZE TO BE SUBSTITUTED inch
M16 x 2	5/8
M20 x 2.5	3/4
M22 x 2.5	7/8
M24 x 3	1
M27 x 3	1-1/8
M30 x 3.5	1-1/4
M36 x 4	1-1/2

SUBSTITUTION TABLE FOR PLAIN WIRE REINFORCEMENT

ASTM Designation: A 82

METRIC SIZE SHOWN ON THE PLANS mm ²	SIZE TO BE SUBSTITUTED inch ² x 100
MW9	W1.4
MW10	W1.6
MW13	W2.0
MW15	W2.3
MW19	W2.9
MW20	W3.1
MW22	W3.5
MW25	W3.9, except W3.5 in piles only
MW26	W4.0
MW30	W4.7
MW32	W5.0
MW35	W5.4
MW40	W6.2
MW45	W6.5
MW50	W7.8
MW55	W8.5, except W8.0 in piles only
MW60	W9.3
MW70	W10.9, except W11.0 in piles only
MW80	W12.4
MW90	W14.0
MW100	W15.5

SUBSTITUTION TABLE FOR BAR REINFORCEMENT

METRIC BAR DESIGNATION NUMBER¹ SHOWN ON THE PLANS	BAR DESIGNATION NUMBER² TO BE SUBSTITUTED
10	3
13	4
16	5
19	6
22	7
25	8
29	9
32	10
36	11
43	14
57	18

¹Bar designation numbers approximate the number of millimeters of the nominal diameter of the bars.

²Bar numbers are based on the number of eighths of an inch included in the nominal diameter of the bars.

No adjustment will be required in spacing or total number of reinforcing bars due to a difference in minimum yield strength between metric and non-metric bars.

SUBSTITUTION TABLE FOR SIZES OF:

(1) STEEL FASTENERS FOR GENERAL APPLICATIONS (ASTM Designation: A 307 or AASHTO Designation: M 314, Grade 36 or 55), and

(2) HIGH STRENGTH STEEL FASTENERS (ASTM Designation: A 325 or A 449)

METRIC SIZE SHOWN ON THE PLANS mm	SIZE TO BE SUBSTITUTED inch
6 or 6.35	1/4
8 or 7.94	5/16
10 or 9.52	3/8
11 or 11.11	7/16
13 or 12.70	1/2
14 or 14.29	9/16
16 or 15.88	5/8
19 or 19.05	3/4
22 or 22.22	7/8
24, 25, or 25.40	1
29 or 28.58	1-1/8
32 or 31.75	1-1/4
35 or 34.93	1-3/8
38 or 38.10	1-1/2
44 or 44.45	1-3/4
51 or 50.80	2
57 or 57.15	2-1/4
64 or 63.50	2-1/2
70 or 69.85	2-3/4
76 or 76.20	3
83 or 82.55	3-1/4
89 or 88.90	3-1/2
95 or 95.25	3-3/4
102 or 101.60	4

SUBSTITUTION TABLE FOR NOMINAL THICKNESS OF SHEET METAL

UNCOATED HOT AND COLD ROLLED SHEETS		HOT-DIPPED ZINC COATED SHEETS (GALVANIZED)	
METRIC THICKNESS SHOWN ON THE PLANS mm	GAGE TO BE SUBSTITUTED inch	METRIC THICKNESS SHOWN ON THE PLANS mm	GAGE TO BE SUBSTITUTED inch
7.94	0.3125	4.270	0.1681
6.07	0.2391	3.891	0.1532
5.69	0.2242	3.510	0.1382
5.31	0.2092	3.132	0.1233
4.94	0.1943	2.753	0.1084
4.55	0.1793	2.372	0.0934
4.18	0.1644	1.994	0.0785
3.80	0.1495	1.803	0.0710
3.42	0.1345	1.613	0.0635
3.04	0.1196	1.461	0.0575
2.66	0.1046	1.311	0.0516
2.28	0.0897	1.158	0.0456
1.90	0.0747	1.006 or 1.016	0.0396
1.71	0.0673	0.930	0.0366
1.52	0.0598	0.853	0.0336
1.37	0.0538	0.777	0.0306
1.21	0.0478	0.701	0.0276
1.06	0.0418	0.627	0.0247
0.91	0.0359	0.551	0.0217
0.84	0.0329	0.513	0.0202
0.76	0.0299	0.475	0.0187
0.68	0.0269	-----	-----
0.61	0.0239	-----	-----
0.53	0.0209	-----	-----
0.45	0.0179	-----	-----
0.42	0.0164	-----	-----
0.38	0.0149	-----	-----

SUBSTITUTION TABLE FOR WIRE

METRIC THICKNESS SHOWN ON THE PLANS mm	WIRE THICKNESS TO BE SUBSTITUTED inch	GAGE NO.
6.20	0.244	3
5.72	0.225	4
5.26	0.207	5
4.88	0.192	6
4.50	0.177	7
4.11	0.162	8
3.76	0.148	9
3.43	0.135	10
3.05	0.120	11
2.69	0.106	12
2.34	0.092	13
2.03	0.080	14
1.83	0.072	15
1.57	0.062	16
1.37	0.054	17
1.22	0.048	18
1.04	0.041	19
0.89	0.035	20

SUBSTITUTION TABLE FOR PIPE PILES

METRIC SIZE SHOWN ON THE PLANS mm x mm	SIZE TO BE SUBSTITUTED inch x inch
PP 360 x 4.55	NPS 14 x 0.179
PP 360 x 6.35	NPS 14 x 0.250
PP 360 x 9.53	NPS 14 x 0.375
PP 360 x 11.12	NPS 14 x 0.438
PP 406 x 12.70	NPS 16 x 0.500
PP 460 x T	NPS 18 x T"
PP 508 x T	NPS 20 x T"
PP 559 x T	NPS 22 x T"
PP 610 x T	NPS 24 x T"
PP 660 x T	NPS 26 x T"
PP 711 x T	NPS 28 x T"
PP 762 x T	NPS 30 x T"
PP 813 x T	NPS 32 x T"
PP 864 x T	NPS 34 x T"
PP 914 x T	NPS 36 x T"
PP 965 x T	NPS 38 x T"
PP 1016 x T	NPS 40 x T"
PP 1067 x T	NPS 42 x T"
PP 1118 x T	NPS 44 x T"
PP 1219 x T	NPS 48 x T"
PP 1524 x T	NPS 60 x T"

The thickness in millimeters (T) represents an exact conversion of the thickness in inches (T").

SUBSTITUTION TABLE FOR STRUCTURAL TIMBER AND LUMBER

METRIC MINIMUM DRESSED DRY, SHOWN ON THE PLANS mm x mm	METRIC MINIMUM DRESSED GREEN, SHOWN ON THE PLANS mm x mm	NOMINAL SIZE TO BE SUBSTITUTED inch x inch
19x89	20x90	1x4
38x89	40x90	2x4
64x89	65x90	3x4
89x89	90x90	4x4
140x140	143x143	6x6
140x184	143x190	6x8
184x184	190x190	8x8
235x235	241x241	10x10
286x286	292x292	12x12

SUBSTITUTION TABLE FOR NAILS AND SPIKES

METRIC COMMON NAIL, SHOWN ON THE PLANS Length, mm Diameter, mm	METRIC BOX NAIL, SHOWN ON THE PLANS Length, mm Diameter, mm	METRIC SPIKE, SHOWN ON THE PLANS Length, mm Diameter, mm	SIZE TO BE SUBSTITUTED Penny-weight
50.80 2.87	50.80 2.51	————	6d
63.50 3.33	63.50 2.87	————	8d
76.20 3.76	76.20 3.25	76.20 4.88	10d
82.55 3.76	82.55 3.25	82.55 4.88	12d
88.90 4.11	88.90 3.43	88.90 5.26	16d
101.60 4.88	101.60 3.76	101.60 5.72	20d
114.30 5.26	114.30 3.76	114.30 6.20	30d
127.00 5.72	127.00 4.11	127.00 6.68	40d
————	————	139.70 7.19	50d
————	————	152.40 7.19	60d

**SUBSTITUTION TABLE FOR IRRIGATION
COMPONENTS**

METRIC WATER METERS, TRUCK LOADING STANDPIPES, VALVES, BACKFLOW PREVENTERS, FLOW SENSORS, WYE STRAINERS, FILTER ASSEMBLY UNITS, PIPE SUPPLY LINES, AND PIPE IRRIGATION SUPPLY LINES SHOWN ON THE PLANS DIAMETER NOMINAL (DN) mm	NOMINAL SIZE TO BE SUBSTITUTED inch
15	1/2
20	3/4
25	1
32	1-1/4
40	1-1/2
50	2
65	2-1/2
75	3
100	4
150	6
200	8
250	10
300	12
350	14
400	16

Unless otherwise specified, substitutions of United States Standard Measures standard structural shapes corresponding to the metric designations shown on the plans and in conformance with the requirements in ASTM Designation: A 6/A 6M, Annex 2, will be allowed.

8-1.02 PREQUALIFIED AND TESTED SIGNING AND DELINEATION MATERIALS

The Department maintains the following list of Prequalified and Tested Signing and Delineation Materials. The Engineer shall not be precluded from sampling and testing products on the list of Prequalified and Tested Signing and Delineation Materials.

The manufacturer of products on the list of Prequalified and Tested Signing and Delineation Materials shall furnish the Engineer a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for each type of traffic product supplied.

For those categories of materials included in the list of Prequalified and Tested Signing and Delineation Materials, only those products shown within the listing may be used in the work. Other categories of products, not included in the list of Prequalified and Tested Signing and Delineation Materials, may be used in the work provided they conform to the requirements of the Standard Specifications.

Materials and products may be added to the list of Prequalified and Tested Signing and Delineation Materials if the manufacturer submits a New Product Information Form to the New Product Coordinator at the Transportation Laboratory. Upon a Departmental request for samples, sufficient samples shall be submitted to permit performance of required tests. Approval of materials or products will depend upon compliance with the specifications and tests the Department may elect to perform.

PAVEMENT MARKERS, PERMANENT TYPE

Retroreflective

- A. Apex, Model 921 (100 mm x 100 mm)
- B. Ray-O-Lite, Models SS (100 mm x 100 mm), RS (100 mm x 100 mm) and AA (100 mm x 100 mm)
- C. Stimsonite, Models 88 (100 mm x 100 mm), 911 (100 mm x 100 mm), 953 (70 mm x 114 mm)
- D. 3M Series 290 (89 mm x 100 mm)

Retroreflective With Abrasion Resistant Surface (ARS)

- A. Apex, Model 921AR (100 mm x 100 mm)
- B. Ray-O-Lite "AA" ARS (100 mm x 100 mm)
- C. Stimsonite, Models 911 (100 mm x 100 mm), 953 (70 mm x 114 mm)
- D. 3M Series 290 (89 mm x 100 mm)

Retroreflective With Abrasion Resistant Surface (ARS)

(Used for recessed applications)

- A. Stimsonite, Model 948 (58 mm x 119 mm)
 - B. Ray-O-Lite, Model 2002 (58 mm x 117 mm)
 - C. Stimsonite, Model 944SB (51 mm x 100 mm)*
 - D. Ray-O-Lite, Model 2004 ARS (51 mm x 100 mm)*
- *For use only in 114 mm wide (older) recessed slots

Non-Reflective For Use With Epoxy Adhesive, 100 mm Round

- A. Apex Universal (Ceramic)
- B. Highway Ceramics, Inc. (Ceramic)

Non-Reflective For Use With Bitumen Adhesive, 100 mm Round

- A. Alpine Products, "D-Dot" and "ANR" (ABS)
- B. Apex Universal (Ceramic)
- C. Apex Universal, Model 929 (ABS)
- D. Elgin Molded Plastics, "Empco-Lite" Model 900 (ABS)
- E. Highway Ceramics, Inc. (Ceramic)
- F. Hi-Way Safety, Inc., Models P20-2000W and 2001Y (ABS)
- G. Interstate Sales, "Diamond Back" (ABS) and (Polypropylene)
- H. Novabrite Models Adot-w (White) Adot-y (Yellow), (ABS)
- I. Road Creations, Model RCB4NR (Acrylic)
- J. Zumar Industries, "Titan TM40A" (ABS)

PAVEMENT MARKERS, TEMPORARY TYPE

Temporary Markers For Long Term Day/Night Use (6 months or less)

- A. Apex Universal, Model 924 (100 mm x 100 mm)
- B. Elgin Molded Plastics, "Empco-Lite" Model 901 (100 mm x 100 mm)
- C. Road Creations, Model R41C (100 mm x 100 mm)
- D. Vega Molded Products "Temporary Road Marker" (75 mm x 100 mm)

Temporary Markers For Short Term Day/Night Use (14 days or less)

(For seal coat or chip seal applications, clear protective covers are required)

- A. Apex Universal, Model 932
- B. Davidson Plastics, Models T.O.M., T.R.P.M., and "HH" (High Heat)
- C. Hi-Way Safety, Inc., Model 1280/1281

STRIPING AND PAVEMENT MARKING MATERIAL

Permanent Traffic Striping and Pavement Marking Tape

- A. Advanced Traffic Marking, Series 300 and 400
- B. Brite-Line, Series 1000
- C. Brite-Line "DeltaLine XRP"
- D. Swarco Industries, "Director 35" (For transverse application only)

- E. Swarco Industries, "Director 60"
- F. 3M, "Stamark" Series 380 and 5730
- G. 3M, "Stamark" Series 420 (For transverse application only)

Temporary (Removable) Striping and Pavement Marking Tape (6 months or less)

- A. Advanced Traffic Marking, Series 200
- B. Brite-Line, Series 100
- C. P.B. Laminations, Aztec, Grade 102
- D. Swarco Industries, "Director-2"
- E. 3M, "Stamark," Series 620
- F. 3M Series A145 Removable Black Line Mask
(Black Tape: For use only on Asphalt Concrete Surfaces)
- G. Advanced Traffic Marking Black "Hide-A-Line"
(Black Tape: For use only on Asphalt Concrete Surfaces)
- H. Brite-Line "BTR" Black Removable Tape
(Black Tape: For use only on Asphalt Concrete Surfaces)

Preformed Thermoplastic (Heated in place)

- A. Flint Trading, "Premark" and "Premark 20/20 Flex"
- B. Pavemark, "Hotape"

Removable Traffic Paint

- A. Belpro, Series 250/252 and No. 93 Remover

Ceramic Surfacing Laminate, 150 mm x 150 mm

- A. Safeline Industries/Highway Ceramics, Inc.

CLASS 1 DELINEATORS

One Piece Driveable Flexible Type, 1700 mm

- A. Carsonite, Curve-Flex CFRM-400
- B. Carsonite, Roadmarker CRM-375
- C. Davidson Plastics, "Flexi-Guide Models 400 and 566"
- D. FlexStake, Model 654 TM
- E. GreenLine Models HWD1-66 and CGD1-66
- F. J. Miller Industries, Model JMI-375 (with soil anchor)

Special Use Flexible Type, 1700 mm

- A. Carsonite, "Survivor" (with 450 mm U-Channel base)
- B. FlexStake, Model 604
- C. GreenLine Models HWD and CGD (with 450 mm U-Channel base)
- D. Safe-Hit with 200 mm pavement anchor (SH248-GP1)
- E. Safe-Hit with 380 mm soil anchor (SH248-GP2) and with 450 mm soil anchor (SH248-GP3)

Surface Mount Flexible Type, 1200 mm

- A. Bent Manufacturing Company, Masterflex Model MF-180EX-48
- B. Carsonite, "Super Duck II"
- C. FlexStake, Surface Mount, Models 704 and 754 TM

CHANNELIZERS

Surface Mount Type, 900 mm

- A. Bent Manufacturing Company, Masterflex Models MF-360-36 (Round) and MF-180-36 (Flat)
- B. Carsonite, "Super Duck" (Flat SDF-436, Round SDR-336)
- C. Carsonite, "Super Duck II" Model SDCF203601MB "The Channelizer"
- D. Davidson Plastics, Flex-Guide Models FG300LD and FG300UR
- E. FlexStake, Surface Mount, Models 703 and 753 TM
- F. GreenLine, Model SMD-36

- G. Hi-Way Safety, Inc. "Channel Guide Channelizer" Model CGC36
- H. The Line Connection, "Dura-Post" Model DP36-3 (Permanent)
- I. The Line Connection, "Dura-Post" Model DP36-3C (Temporary)
- J. Repo, Models 300 and 400
- K. Safe-Hit, Guide Post, Model SH236SMA

CONICAL DELINEATORS, 1070 mm

(For 700 mm Traffic Cones, see Standard Specifications)

- A. Bent Manufacturing Company "T-Top"
- B. Plastic Safety Systems "Navigator-42"
- C. Roadmaker Company "Stacker"
- D. Traffix Devices "Grabber"

OBJECT MARKERS

Type "K", 450 mm

- A. Carsonite, Model SMD-615
- B. FlexStake, Model 701 KM
- C. Repo, Models 300 and 400
- D. Safe-Hit, Model SH718SMA
- E. The Line Connection, Model DP21-4K

Type "K-4" / "Q" Object Markers, 600 mm

- A. Bent Manufacturing "Masterflex" Model MF-360-24
- B. Carsonite, Super Duck II
- C. FlexStake, Model 701KM
- D. Repo, Models 300 and 400
- E. Safe-Hit, Models SH8 24SMA_WA and SH8 24GP3_WA
- F. The Line Connection, Model DP21-4Q

TEMPORARY RAILING (TYPE K) REFLECTORS AND CONCRETE BARRIER MARKERS

Impactable Type

- A. ARTUK, "FB"
- B. Davidson Plastics, Model PCBM-12
- C. Duraflex Corp., "Flexx 2020" and "Electriflexx"
- D. Hi-Way Safety, Inc., Model GMKRM100

Non-Impactable Type

- A. ARTUK, JD Series
- B. Stimsonite, Model 967 (with 83 mm Acrylic cube corner reflector)
- C. Stimsonite, Model 967LS
- D. Vega Molded Products, Models GBM and JD

THREE BEAM BARRIER MARKERS

(For use to the left of traffic)

- A. Duraflex Corp., "Railrider"
- B. Davidson Plastics, "Mini" (75 mm x 254 mm)

CONCRETE BARRIER DELINEATORS, 400 mm

(For use to the right of traffic. When mounted on top of barrier, places top of reflective element at 1200 mm)

- A. Davidson Plastics, Model PCBM T-16
- B. Safe-Hit, Model SH216RBM
- C. Sun-Lab Technology, "Safety Guide Light, Model TM," 130 mm x 130 mm x 80 mm

CONCRETE BARRIER-MOUNTED MINI-DRUM (260 mm x 360 mm x 570 mm)

- A. Stinson Equipment Company "SaddleMarker"

SOUND WALL DELINEATOR

(Applied vertically. Place top of 75 mm x 300 mm reflective element at 1200 mm above roadway)

- A. Davidson Plastics, PCBM S-36
- B. Sun-Lab Technology, "Safety Guide Light, Model SM12," 130 mm x 130 mm x 80 mm

GUARD RAILING DELINEATOR

(Top of reflective element at 1200 mm above plane of roadway)

Wood Post Type, 686 mm

- A. Carsonite, Model 427
- B. Davidson Plastics FG 427 and FG 527
- C. FlexStake, Model 102 GR
- D. GreenLine GRD 27
- E. J. Miller Model JMI-375G
- F. Safe-Hit, Model SH227GRD

Steel Post Type

- A. Carsonite, Model CFGR-327 with CFGRBK300 Mounting Bracket

RETROREFLECTIVE SHEETING

Channelizers, Barrier Markers, and Delineators

- A. 3M, High Intensity
- B. Reflexite, PC-1000 Metalized Polycarbonate
- C. Reflexite, AC-1000 Acrylic
- D. Reflexite, AP-1000 Metalized Polyester
- E. Reflexite, AR-1000 Abrasion Resistant Coating
- F. Avery Dennison T-6500 Series (Formerly Stimsonite, Series 6200) (For rigid substrate devices only)

Traffic Cones, 330 mm Sleeves

- A. Reflexite SB (Polyester), Vinyl or "TR" (Semi-transparent)

Traffic Cones, 100 mm and 150 mm Sleeves

- A. 3M Series 3840
- B. Reflexite Vinyl, "TR" (Semi-transparent) or "Conformalite"

Barrels and Drums

- A. Reflexite, "Super High Intensity" or "High Impact Drum Sheeting"
- B. 3M Series 3810

Barricades: Type I, Engineer Grade

- A. American Decal, Adcolite
- B. Avery Dennison, T-1500 and T-1600
- C. 3M, Scotchlite, Series CW

Barricades: Type II, Super Engineer Grade

- A. Avery Dennison, T-2500 Series
- B. Kiwalite Type II
- C. Nikkalite 1800 Series

Signs: Type II, Super Engineer Grade

- A. Avery Dennison, T-2500 Series
- B. Kiwalite, Type II
- C. Nikkalite 1800 Series

Signs: Type III, High-Intensity Grade

- A. 3M Series 3800
- B. Nippon Carbide, Nikkalite Brand Ultralite Grade II

Signs: Type IV, High-Intensity Prismatic Grade

- A. Avery Dennison T-6500 (Formerly Stimsonite Series 6200)

Signs: Type VII, High-Intensity Prismatic Grade

- A. 3M Series 3900

Signs: Type VI, Roll-Up Signs

- A. Reflexite, Vinyl (Orange)
- B. Reflexite "SuperBright" (Fluorescent orange)
- C. Reflexite "Marathon" (Fluorescent orange)
- D. 3M Series RS34 (Orange) and RS20 (Fluorescent orange)

SPECIALTY SIGN (All Plastic)

- A. All Sign Products, STOP Sign, 750 mm

SIGN SUBSTRATE FOR CONSTRUCTION AREA SIGNS

Aluminum

Fiberglass Reinforced Plastic (FRP)

- A. Sequentia, "Polyplate"
- B. Fiber-Brite

8-1.03 STATE-FURNISHED MATERIALS

Attention is directed to Section 6-1.02, "State-Furnished Materials," of the Standard Specifications and these special provisions.

The following materials will be furnished to the Contractor:

- .
- A. Modems
- B. Self-adhesive reflective numbers and edge sealer for numbering electrical equipment.
- C. 2 Model 500X CMS systems (including 2 cabinets, 2 controllers and cable.)
- D. Traffic count station cabinet (including loop detector sensors.)

Completely wired Model 170 Type 334 controller cabinets, with auxiliary equipment but without controller unit and loop detector sensor units for traffic monitoring stations systems, self-adhesive reflective numbers and edge sealer for numbering electrical equipment will be furnished to the Contractor at the following address:

Department of Transportation
District Maintenance Yard
7310 East Bandini Boulevard
Commerce, CA 90040

Model 500X changeable message sign, wiring harness, and controller assembly, including the controller unit, CMS control cables and completely wired cabinet, will be furnished to the Contractor at a location near job site designated by the Engineer, no more than 50 miles away.

The Contractor shall notify the Engineer not less than fifteen working days before State-furnished material is to be picked up by the Contractor. A full description of the material and the time the material will be picked up shall be provided.

8-1.04 SLAG AGGREGATE

Aggregate produced from slag resulting from any steel-making process or from air-cooled iron blast furnace slag shall not be used on this project.

SECTION 8-2. CONCRETE

8-2.01 PORTLAND CEMENT CONCRETE

Portland cement concrete shall conform to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications and these special provisions.

References to Section 90-2.01, "Portland Cement," of the Standard Specifications shall mean Section 90-2.01, "Cement," of the Standard Specifications.

Mineral admixture shall be combined with cement in conformance with the provisions in Section 90-4.08, "Required Use of Mineral Admixtures," of the Standard Specifications for the concrete materials specified in Section 56-2, "Roadside Signs," of the Standard Specifications.

The requirements of Section 90-4.08, "Required Use of Mineral Admixture," of the Standard Specifications shall not apply to Section 19-3.025C, "Soil Cement Bedding," of the Standard Specifications.

8-2.02 CEMENT AND WATER CONTENT

The amount of free water used in concrete for structure approach slabs shall not exceed 195 kg/m³, plus 20 kg for each required 100 kg of cementitious material in excess of 400 kg/m³.

SECTION 8-3. WELDING

8-3.01 WELDING

GENERAL

Flux core welding electrodes conforming to the requirements of AWS A5.20 E6XT-4 or E7XT-4 shall not be used to perform any type of welding for this project.

Wherever reference is made to the following AWS welding codes in the Standard Specifications, on the plans, or in these special provisions, the year of adoption for these codes shall be as listed:

AWS Code	Year of Adoption
D1.1	2000
D1.4	1992
D1.5	1995
D1.5 (metric only)	1996

Requirements of the AWS welding codes shall apply unless specified otherwise in the Standard Specifications, on the plans, or in these special provisions. Wherever the abbreviation AWS is used, it shall be equivalent to the abbreviations ANSI/AWS or ANSI/AASHTO/AWS.

Sections 6.1.2 through 6.1.4.3 of AWS D 1.1, Sections 7.1.1 and 7.1.2 of AWS D 1.4, and Sections 6.1.1.1 through 6.1.3.3 of AWS D 1.5 are replaced with the following:

Quality Control (QC) shall be the responsibility of the Contractor. As a minimum, the Contractor shall perform inspection and testing prior to welding, during welding, and after welding as specified in this section and additionally as necessary to ensure that materials and workmanship conform to the requirements of the contract documents.

The QC Inspector shall be the duly designated person who acts for and on behalf of the Contractor for inspection, testing, and quality related matters for all welding.

Quality Assurance (QA) is the prerogative of the Engineer. The QA Inspector is the duly designated person who acts for and on behalf of the Engineer.

Each QC Inspector shall be responsible for quality control acceptance or rejection of materials and workmanship, and shall be currently certified as an AWS Certified Welding Inspector (CWI) in conformance with the requirements in AWS QC1, "Standard and Guide for Qualification of Welding Inspectors."

The QC Inspector may be assisted by an Assistant QC Inspector provided that this individual is currently certified as an AWS Certified Associate Welding Inspector (CAWI) in conformance with the requirements in AWS QC1, "Standard and Guide for Qualification of Welding Inspectors," or has equivalent qualifications. The QC Inspector shall monitor the Assistant QC Inspector's work, and shall be responsible for signing all reports.

When the term "Inspector" is used without further qualification, it shall refer to the QC Inspector.

Section 6.14.6, "Personnel Qualification," of AWS D 1.1, Section 7.7.6, "Personnel Qualification," of AWS D 1.4, and Section 6.1.3.4, "Personnel Qualification," of AWS D 1.5 are replaced with the following:

Personnel performing nondestructive testing (NDT) shall be qualified in conformance with the requirements of the American Society for Nondestructive Testing (ASNT) Recommended Practice No. SNT-TC-1A and the Written Practice of the NDT firm. The Written Practice of the NDT firm shall meet or exceed the requirements of the ASNT Recommended Practice No. SNT-TC-1A. Only individuals who are 1) qualified for NDT Level II, or 2) Level III technicians who have been

directly certified by the ASNT and are authorized to perform the work of Level II technicians, shall perform NDT, review the results, and prepare the written reports.

Section 6.5.4, "Scope of Examination," of AWS D 1.1 and Section 7.5.4 of AWS D 1.4 are replaced with the following:

The QC Inspector shall inspect and approve the joint preparation, assembly practice, welding techniques, and performance of each welder, welding operator, and tack welder to make certain that the applicable requirements of this code and the approved welding procedure specification (WPS) are met.

Section 6.5.4 of AWS D 1.5 is replaced with the following:

The QC Inspector shall inspect and approve the joint preparation, assembly practice, welding techniques, and performance of each welder, welding operator, and tack welder to make certain that the applicable requirements of this code and the approved WPS are met. The QC Inspector shall examine the work to make certain that it meets the requirements of Sections 3 and 9.21. The size and contour of welds shall be measured using suitable gages. Visual inspection for cracks in welds and base metal, and for other discontinuities should be aided by strong light magnifiers, or such other devices as may be helpful. Acceptance criteria different from those specified in this code may be used when approved by the Engineer.

Section 6.6.5, "Nonspecified Nondestructive Testing Other Than Visual," of AWS D 1.1, Section 6.6.5 of AWS D 1.4 and Section 6.6.5 of AWS D 1.5 shall not apply.

For any welding, the Engineer may direct the Contractor to perform NDT that is in addition to the visual inspection or NDT specified in the AWS welding codes, in the Standard Specifications, or in these special provisions. Additional NDT required by the Engineer, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications. Should any welding deficiencies be discovered by this additional NDT, the cost of the testing will not be paid for as extra work but shall be at the Contractor's expense.

Required repair work to correct welding deficiencies, whether discovered by the required visual inspection or NDT, or by additional NDT directed by the Engineer, and any associated delays or expenses caused to the Contractor by performing these repairs, shall be at the Contractor's expense.

The Engineer shall have the authority to verify the qualifications or certifications of any welder, QC Inspector, or NDT personnel to specified levels by retests or other means.

A sufficient number of QC Inspectors shall be provided to ensure continuous inspection when any welding is being performed. Continuous inspection, as a minimum, shall include (1) having QC Inspectors continually present when any welding operation is being performed, or (2) having a QC Inspector within such close proximity of all welding operations that inspections by the QC Inspector of each operation, at each welding location, shall not lapse for a period exceeding 30 minutes.

Inspection and approval of the joint preparation, assembly practice, welding techniques, and performance of each welder, welding operator, and tack welder shall be documented by the QC Inspector on a daily basis for each day that welding is performed.

When joint details that are not prequalified by the applicable AWS codes are proposed for use in the work, welders using these details shall perform a qualification test plate using the approved WPS variables and the joint detail to be used in production. The test plate shall be the maximum thickness to be used in production. The test plate shall be mechanically or radiographically tested as directed by the Engineer. Mechanical and radiographic testing and acceptance criteria shall be as specified in the applicable AWS codes.

The period of effectiveness for a welder's or welding operator's qualification shall be a maximum of 3 years for the same weld process, welding position, and weld type. A valid qualification at the beginning of work on a contract will be acceptable for the entire period of the contract, as long as the welder's work remains satisfactory.

WELDING QUALITY CONTROL

Welding quality control shall conform to the requirements in the AWS welding codes, the Standard Specifications, and these special provisions.

Unless otherwise specified, welding quality control shall apply when any work is welded in conformance with the provisions in Section 49, "Piling," Section 52, "Reinforcement," Section 55, "Steel Structures," Section 56-1, "Overhead Sign Structures," Section 75-1.035, "Bridge Joint Restrainer Units," or Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications.

The welding of fracture critical members (FCMs) shall conform to the provisions specified in the Fracture Control Plan (FCP) and herein.

The Contractor shall designate in writing a welding Quality Control Manager (QCM). The QCM shall be responsible directly to the Contractor for the quality of welding, including materials and workmanship, performed by the Contractor and subcontractors.

The QCM shall be the sole individual responsible to the Contractor for submitting, receiving, and approving all correspondence, required submittals, and reports to and from the Engineer.

The QCM shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project. The QCM may be an employee of the Contractor.

Welding inspection personnel or NDT firms to be used in the work shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project, except for the following conditions:

- A. The welding is performed at a permanent fabrication facility which is certified under the AISC Quality Certification Program, Category Cbr, Major Steel Bridges.
- B. The welding is performed at a permanent fabrication facility which is certified under the AISC Quality Certification Program, Category Sbd, Conventional Steel Building Structures. This condition shall apply only for work welded in conformance with the provisions in Section 56-1, "Overhead Sign Structures" or Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications.

For welding performed at such certified facilities, the inspection personnel or NDT firms may be employed or compensated by the fabrication facility performing the welding.

Prior to submitting the Welding Quality Control Plan (WQCP) required herein, a pre-welding meeting between the Engineer, Contractor, and any entity performing welding for this project, shall be held to discuss the requirements for the WQCP.

Except for work that is welded in conformance with Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications, prior to performing any welding, the Contractor shall submit to the Engineer, in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications, 3 copies of a separate WQCP for each item of work for which welding is to be performed.

Prior to furnishing materials welded in conformance with Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications, the Contractor shall submit to the Engineer, in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications, 3 copies of a separate WQCP for each fabrication facility supplying these materials or proof of previous Engineer approval of a WQCP for such a facility no more than one year prior to the delivery of materials for inspection.

As a minimum, each WQCP shall include the following:

- A. The name of the welding firm and any required NDT firms;
- B. A manual prepared by the NDT firm that shall include equipment, testing procedures, code of safe practices, the Written Practice of the NDT firm, and the names, qualifications, and documentation of certifications for all personnel to be used;
- C. The name of the QCM and the names, qualifications, and documentation of certifications for all QC Inspectors and Assistant QC Inspectors to be used;
- D. An organizational chart showing all QC personnel and their assigned QC responsibilities;
- E. The methods and frequencies for performing all required quality control procedures, including QC inspection forms to be used, as required by the specifications including:
 - 1. all visual inspections;
 - 2. all NDT including radiographic geometry, penetrometer and shim selection, film quality, film processing, radiograph identification and marking system, and film interpretation and reports; and
 - 3. calibration procedures and calibration frequency for all NDT equipment;
- F. A system for the identification and tracking of all welds, NDT, and any required repairs, and a procedure for the reinspection of repaired welds. The system shall have provisions for 1) permanently identifying each weld and the person who performed the weld, 2) placing all identification and tracking information on each radiograph, 3) a method of reporting nonconforming welds to the Engineer, and 4) a method of documentation of repairs and reinspection of nonconforming welds;

- G. Standard procedures for performing noncritical repair welds. Noncritical repair welds are defined as welds to deposit additional weld beads or layers to compensate for insufficient weld size and to fill limited excavations that were performed to remove unacceptable edge or surface discontinuities, rollover or undercut. The depth of these excavations shall not exceed 65 percent of the specified weld size;
- H. The WPS, including documentation of all supporting Procedure Qualification Record (PQR) tests performed, and the name of the testing laboratory who performed the tests, to verify the acceptability of the WPS. The submitted WPS shall be within the allowable period of effectiveness;
- I. Documentation of all certifications for welders for each weld process and position that will be used. Certifications shall list the electrodes used, test position, base metal and thickness, tests performed, and the witnessing authority. All certifications shall be within the allowable period of effectiveness;
- J. One copy each of all AWS welding codes and the FCP which are applicable to the welding to be performed. These codes and the FCP shall become the permanent property of the Department; and
- K. Forms to be used for Certificates of Compliance, daily production logs, and daily reports.

The Engineer shall have 10 working days to review the WQCP submittal after a complete plan has been received. Except for work that is welded in conformance with Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications, no welding shall be performed until the WQCP is approved in writing by the Engineer. No materials welded in conformance with Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications, shall be incorporated into the work until the WQCP is approved in writing by the Engineer. Should the Engineer fail to complete the review within this time allowance and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the WQCP, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

An amended WQCP or addendum shall be submitted to, and approved in writing by the Engineer, for proposed revisions to the approved WQCP. An amended WQCP or addendum will be required for revisions to the WQCP, including but not limited to a revised WPS, additional welders, changes in NDT firms or procedures, QC, or NDT personnel, or updated systems for tracking and identifying welds. The Engineer shall have 3 working days to complete the review of the amended WQCP or addendum. Work that is affected by any of the proposed revisions shall not be performed until the amended WQCP or addendum has been approved. Should the Engineer fail to complete the review within this time allowance and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the amended WQCP or addendum, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

After final approval of the WQCP, amended WQCP, or addendum, the Contractor shall submit 7 copies to the Engineer of each of these approved documents.

It is expressly understood that the Engineer's approval of the Contractor's WQCP shall not relieve the Contractor of any responsibility under the contract for the successful completion of the work in conformity with the requirements of the plans and specifications. The Engineer's approval shall not constitute a waiver of any requirement of the plans and specifications nor relieve the Contractor of any obligation thereunder, and defective work, materials, and equipment may be rejected notwithstanding approval of the WQCP.

A daily production log for welding shall be kept by the QCM for each day that welding is performed. The log shall clearly indicate the locations of all welding, except partial penetration longitudinal seam welds performed in conformance with Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications. The log shall include the welders' names, amount of welding performed, any problems or deficiencies discovered, and any testing or repair work performed, at each location. The daily report from each QC Inspector shall also be included in the log.

The following items shall be included in a Welding Report that is to be submitted to the Engineer within 7 days following the performance of any welding. For work welded in conformance with Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications, the following items shall be included in a Welding Report that is to be submitted to the Engineer 48 hours prior to the Contractor furnishing a Certificate of Compliance for the material:

- A. Reports of all visual weld inspections and NDT;
- B. Radiographs and radiographic reports, and other required NDT reports;
- C. Documentation that the Contractor has evaluated all radiographs and other nondestructive tests and corrected all rejectable deficiencies, and all repaired welds have been reexamined by the required NDT and found acceptable; and
- D. Daily production log.

Radiographic envelopes shall have clearly written on the outside of the envelope the following information: name of the QCM, name of the nondestructive testing firm, name of the radiographer, date, contract number, complete part description, and all included weld numbers or a report number, as detailed in the WQCP. In addition, all innerleaves shall have clearly written on them the part description and all included weld numbers, as detailed in the WQCP.

Reports regarding NDT, including radiographs, shall be signed by both the NDT technician and the person that performed the review, and then submitted directly to the QCM for review and signature prior to submittal to the Engineer. Corresponding names shall be clearly printed or typewritten next to all signatures.

The Engineer will review the Welding Report to determine if the Contractor is in conformance with the WQCP. Unless otherwise specified, the Engineer shall be allowed 7 working days to review the report and respond in writing after a complete Welding Report has been received. Prior to receiving notification from the Engineer of the Contractor's conformance with the WQCP, the Contractor may encase in concrete or cover welds for which a Welding Report has been submitted. However, should the Contractor elect to encase or cover those welds prior to receiving notification from the Engineer, it is expressly understood that the Contractor shall not be relieved of the responsibility for incorporating material in the work that conforms to the requirements of the plans and specifications. Material not conforming to these requirements will be subject to rejection. Should the Contractor elect to wait to encase or cover welds pending notification by the Engineer, and should the Engineer fail to complete the review and provide notification within this time allowance, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in notification, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

The QC Inspector shall provide reports to the QCM on a daily basis for each day that welding is performed.

Except for noncritical weld repairs, the Engineer shall be notified immediately in writing when welding problems, deficiencies, base metal repairs, or any other type of repairs not submitted in the WQCP are discovered and also of the proposed repair procedures to correct them. The Engineer shall have 5 working days to review these procedures. No remedial work shall begin until the repair procedures are approved in writing by the Engineer. Should the Engineer fail to complete the review within this time allowance, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the proposed repair procedures, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

The QCM shall sign and furnish to the Engineer, a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for each item of work for which welding was performed. The certificate shall state that all of the materials and workmanship incorporated in the work, and all required tests and inspections of this work, have been performed in conformance with the details shown on the plans and the provisions of the Standard Specifications and these special provisions.

PAYMENT

Full compensation for conforming to the requirements of this section shall be considered as included in the contract prices paid for the various items of work involved and no additional compensation will be allowed therefor.

SECTION 9. DESCRIPTION OF BRIDGE WORK

The bridge work to be done consists in general, of placing fiber optic conduits for the following structures:

RIPPLE STREET UNDERCROSSING
(Bridge No. 53-0283)

L.A. RIVER UNDERCROSSING
(Bridge No. 53-0255)

TAYLOR YARD OVERHEAD
(Bridge No. 53-1039)

SAN FERNANDO ROAD UNDERCROSSING
(Bridge No. 53-0743)

DELAY DRIVE OVERHEAD
(Bridge No. 53-1040)

VERDUGO ROAD UNDERCROSSING
(Bridge No. 53-1929)

YORK BOULEVARD UNDERCROSSING
(Bridge No. 53-1993)

ROUND TOP DRIVE UNDERCROSSING
(Bridge No. 53-1975)

COLORADO BOULEVARD SEPARATION (2/134)
(Bridge No. 53-1915)

BROADWAY UNDERCROSSING
(Bridge No. 53-1916)

GLENOAKS BOULEVARD UNDERCROSSING
(Bridge No. 53-1967)

SHERER LANE UNDERCROSSING
(Bridge No. 53-1894)

CHEVY CHASE DRIVE UNDERCROSSING
(Bridge No. 53-1968)

FERN LANE UNDERCROSSING
(Bridge No. 53-2366)

STANCREST DRIVE UNDERCROSSING
(Bridge No. 53-2242)

VERDUGO BOULEVARD UNDERCROSSING (CONNECTOR)
(Bridge No. 53-2220G)

SECTION 10. CONSTRUCTION DETAILS

SECTION 10-1. GENERAL

10-1.00 CONSTRUCTION PROJECT INFORMATION SIGNS

Before any major physical construction work readily visible to highway users is started on this contract, the Contractor shall furnish and erect 2 Type 2 Construction Project Information signs at the locations designated by the Engineer.

The signs and overlays shall be of a type and material consistent with the estimated time of completion of the project and shall conform to the details shown on the plans.

The sign letters, border and the Department's construction logos shall conform to the colors (non-reflective) and details shown on the plans, and shall be on a white background (non-reflective). The colors blue and orange shall conform to PR Color Number 3 and Number 6, respectively, as specified in the Federal Highway Administration's Color Tolerance Chart.

The sign message to be used for fund types shall consist of the following, in the order shown:

FEDERAL HIGHWAY TRUST FUNDS

The sign message to be used for type of work shall consist of the following:

HIGHWAY IMPROVEMENT

The sign message to be used for the Year of Completion of Project Construction will be furnished by the Engineer. The Contractor shall furnish and install the "Year" sign overlay within 10 working days of notification of the year date to be used.

The letter sizes to be used shall be as shown on the plans. The information shown on the signs shall be limited to that shown on the plans.

The signs shall be kept clean and in good repair by the Contractor.

Upon completion of the work, the signs shall be removed and disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13 of the Standard Specifications.

Full compensation for furnishing, erecting, maintaining, and removing and disposing of the construction project information signs shall be considered as included in the contract lump sum price paid for construction area signs and no additional compensation will be allowed therefor.

10-1.01 ORDER OF WORK

Order of work shall conform to the provisions in Section 5-1.05, "Order of Work," of the Standard Specifications and these special provisions.

The first order of work shall be to place the order for the timber for the timber retaining wall and for the electrical and CCTV communication systems equipment and the fiber optic cables. The Contractor shall furnish the Engineer with a statement from the vendor that the order for the electrical and CCTV communication systems equipment and the fiber optic cables have been received and accepted by the vendor.

Attention is directed to "Maintaining Traffic" .

Attention is directed to "Progress Schedule (Critical Path Method)" of these special provisions regarding the submittal of a general time-scaled logic diagram within 10 days after approval of the contract.

At those locations exposed to public traffic where guard railings are to be constructed the Contractor shall schedule operations so that at the end of each working day there shall be no post holes open nor shall there be any railing posts installed without the blocks and rail elements assembled and mounted thereon.

Construction operations shall not be performed in areas where existing irrigation facilities are to remain in place until existing irrigation facilities have been checked for proper operation in conformance with the provisions in "Check and Test Existing Irrigation Facilities" of these special provisions.

10-1.02 WATER POLLUTION CONTROL

Water pollution control work shall conform to the provisions in Section 7-1.01G, "Water Pollution," of the Standard Specifications and these special provisions.

Water pollution control work shall conform to the requirements in the "Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual" and the "Construction Site Best Management Practices (BMPs) Manual," and addenda thereto issued up to, and including, the date of advertisement of the project, hereafter referred to respectively as the "Preparation Manual" and the "Construction Site BMP Manual" and collectively as the "Manuals." Copies of the Manuals may be obtained from the Department of Transportation, Material Operations Branch, Publication Distribution Unit, 1900 Royal Oaks Drive, Sacramento, California 95815, Telephone: (916) 445-3520. Copies of the Manuals may also be obtained from the Department's Internet Web Site at: <http://www.dot.ca.gov/hq/construc/stormwater.html>.

Copies of the Manuals are also available for review at the Department of Transportation, Construction Office, Room 244, 120 South Spring Street, Los Angeles, California 90012, Telephone: (213) 897-0054.

The Contractor shall know and fully comply with the applicable provisions of the Manuals and Federal, State, and local regulations that govern the Contractor's operations and storm water discharges from both the project site and areas of disturbance outside the project limits during construction.

Unless arrangements for disturbance of areas outside the project limits are made by the Department and made part of the contract, it is expressly agreed that the Department assumes no responsibility whatsoever to the Contractor or property owner with respect to any arrangements made between the Contractor and property owner to allow disturbance of areas outside the project limits.

The Contractor shall be responsible for the costs and for liabilities imposed by law as a result of the Contractor's failure to comply with the requirements set forth in this section "Water Pollution Control" including, but not limited to, compliance with the applicable provisions of the Manuals and Federal, State, and local regulations. For the purposes of this paragraph, costs and liabilities include, but are not limited to, fines, penalties, and damages whether assessed against the State or the Contractor, including those levied under the Federal Clean Water Act and the State Porter Cologne Water Quality Act.

In addition to the remedies authorized by law, an amount of the money due the Contractor under the contract, as determined by the Department, may be retained by the State of California until disposition has been made of the costs and liabilities.

The retention of money due the Contractor shall be subject to the following:

- A. The Department will give the Contractor 30 days notice of the Department's intention to retain funds from partial payments which may become due to the Contractor prior to acceptance of the contract. Retention of funds from payments made after acceptance of the contract may be made without prior notice to the Contractor.
- B. No retention of additional amounts out of partial payments will be made if the amount to be retained does not exceed the amount being withheld from partial payments pursuant to Section 9-1.06, "Partial Payments," of the Standard Specifications.
- C. If the Department has retained funds and it is subsequently determined that the State is not subject to the costs and liabilities in connection with the matter for which the retention was made, the Department shall be liable for interest on the amount retained at the legal rate of interest for the period of the retention.

Conformance with the provisions in this section "Water Pollution Control" shall not relieve the Contractor from the Contractor's responsibilities as provided in Section 7, "Legal Relations and Responsibilities," of the Standard Specifications.

WATER POLLUTION CONTROL PROGRAM PREPARATION, APPROVAL AND UPDATES

As part of the water pollution control work, a Water Pollution Control Program, hereafter referred to as the "WPCP," is required for this contract. The WPCP shall conform to the provisions in Section 7-1.01G, "Water Pollution," of the Standard Specifications, the requirements in the Manuals, and these special provisions.

No work having potential to cause water pollution, as determined by the Engineer, shall be performed until the WPCP has been approved by the Engineer.

Within 30 days after the approval of the contract, the Contractor shall submit 3 copies of the WPCP to the Engineer. The Engineer will have 7 days to review the WPCP. If revisions are required, as determined by the Engineer, the Contractor shall revise and resubmit the WPCP within 7 days of receipt of the Engineer's comments. The Engineer will have 7 days to review the revisions. Upon the Engineer's approval of the WPCP, 3 additional copies of the WPCP incorporating the required changes shall be submitted to the Engineer. Minor changes or clarifications to the initial submittal may be made and attached as amendments to the WPCP. In order to allow construction activities to proceed, the Engineer may conditionally approve the WPCP while minor revisions or amendments are being completed.

The WPCP shall identify pollution sources that may adversely affect the quality of storm water discharges associated with the project and shall identify water pollution control measures, hereafter referred to as control measures, to be constructed, implemented, and maintained in order to reduce to the extent feasible pollutants in storm water discharges from the construction site during construction under this contract.

The WPCP shall incorporate control measures in the following categories:

- A. Soil stabilization;
- B. Sediment control;
- C. Tracking control;
- D. Wind erosion control;
- E. Non-storm water control; and
- F. Waste management and material pollution control.

Specific objectives and minimum requirements for each category of control measures are contained in the Manuals.

The Contractor shall consider the objectives and minimum requirements presented in the Manuals for each of the above categories. When minimum requirements are listed for any category, the Contractor shall incorporate into the WPCP and implement on the project, one or more of the listed minimum controls required in order to meet the pollution control objectives for the category. In addition, the Contractor shall consider other control measures presented in the Manuals and shall incorporate into the WPCP and implement on the project the control measures necessary to meet the objectives of the WPCP. The Contractor shall document the selection process in conformance with the procedure specified in the Manuals.

The WPCP shall include, but not be limited to, the following items as described in the Preparation Manual:

- A. Project description and Contractor's certification;
- B. Project information;
- C. Pollution sources, control measures, and water pollution control drawings; and
- D. Amendments, if any.

The Contractor shall amend the WPCP, graphically and in narrative form, whenever there is a change in construction activities or operations which may affect the discharge of significant quantities of pollutants to surface waters, ground waters, municipal storm drain systems or when deemed necessary by the Engineer. The WPCP shall be amended if the WPCP has not achieved the objective of reducing pollutants in storm water discharges. Amendments shall show additional control measures or revised operations, including those in areas not shown in the initially approved WPCP, which are required on the project to control water pollution effectively. Amendments to the WPCP shall be submitted for review and approval by the Engineer in the same manner specified for the initially approved WPCP. Amendments shall be dated and attached to the on-site WPCP document.

The Contractor shall keep a copy of the WPCP, together with updates, revisions and amendments at the project site.

WPCP IMPLEMENTATION

Upon approval of the WPCP, the Contractor shall be responsible throughout the duration of the project for installing, constructing, inspecting, and maintaining the control measures included in the WPCP and any amendments thereto and for removing and disposing of temporary control measures. Unless otherwise directed by the Engineer or specified in these special provisions, the Contractor's responsibility for WPCP implementation shall continue throughout any temporary

suspension of work ordered in conformance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications. Requirements for installation, construction, inspection, maintenance, removal, and disposal of control measures are specified in the Manuals and these special provisions.

Soil stabilization practices and sediment control measures, including minimum requirements, shall be provided throughout the rainy season, defined as between October 1 and May 1.

Implementation of soil stabilization practices and sediment control measures for soil-disturbed areas on the project site shall be completed, except as provided for below, not later than 20 days prior to the beginning of the rainy season or upon start of applicable construction activities for projects which begin either during or within 20 days of the rainy season.

Throughout the rainy season, the active, soil-disturbed area of the project site shall be not more than 1.9 hectares. The Engineer may approve, on a case-by-case basis, expansions of the active, soil-disturbed area limit. The Contractor shall demonstrate the ability and preparedness to fully deploy soil stabilization practices and sediment control measures to protect soil-disturbed areas on the project site before the onset of precipitation. A quantity of soil stabilization and sediment control materials shall be maintained on site equal to 100 percent of that sufficient to protect unprotected, soil-disturbed areas on the project site. A detailed plan for the mobilization of sufficient labor and equipment shall be maintained to fully deploy control measures required to protect unprotected, soil-disturbed areas on the project site prior to the onset of precipitation. A current inventory of control measure materials and the detailed mobilization plan shall be included as part of the WPCP.

Throughout the rainy season, soil-disturbed areas on the project site shall be considered to be nonactive whenever soil disturbing activities are expected to be discontinued for a period of 20 or more days and the areas are fully protected. Areas that will become nonactive either during the rainy season or within 20 days thereof shall be fully protected with soil stabilization practices and sediment control measures within 10 days of the discontinuance of soil disturbing activities or prior to the onset of precipitation, whichever is first to occur.

Throughout the rainy season, active soil-disturbed areas of the project site shall be fully protected at the end of each day with soil stabilization practices and sediment control measures unless fair weather is predicted through the following work day. The weather forecast shall be monitored by the Contractor on a daily basis. The National Weather Service forecast shall be used. An alternative weather forecast proposed by the Contractor may be used if approved by the Engineer. If precipitation is predicted prior to the end of the following work day, construction scheduling shall be modified, as required, and functioning control measures shall be deployed prior to the onset of the precipitation.

The Contractor shall implement, year-round and throughout the duration of the project, control measures included in the WPCP for tracking control, wind erosion control, non-storm water control, and waste management and material pollution control.

The Engineer may order the suspension of construction operations which create water pollution if the Contractor fails to conform to the provisions in this section "Water Pollution Control" as determined by the Engineer.

MAINTENANCE

To ensure the proper implementation and functioning of control measures, the Contractor shall regularly inspect and maintain the construction site for the control measures identified in the WPCP. The Contractor shall identify corrective actions and time needed to address any deficient measures or reinitiate any measures that have been discontinued.

The construction site inspection checklist provided in the Preparation Manual shall be used to ensure that the necessary measures are being properly implemented, and to ensure that the control measures are functioning adequately. One copy of each site inspection record shall be submitted to the Engineer.

During the rainy season, inspections of the construction site shall be conducted by the Contractor to identify deficient measures, as follows:

- A. Prior to a forecast storm;
- B. After all precipitation which causes runoff capable of carrying sediment from the construction site;
- C. At 24-hour intervals during extended precipitation events; and
- D. Routinely, at a minimum of once every 2 weeks.

If the Contractor or the Engineer identifies a deficiency in the deployment or functioning of an identified control measure, the deficiency shall be corrected immediately. The deficiency may be corrected at a later date and time if requested by the Contractor and approved by the Engineer in writing, but not later than the onset of subsequent precipitation events. The correction of deficiencies shall be at no additional cost to the State.

PAYMENT

Full compensation for conforming to the provisions in this section shall be considered as included in the prices paid for the various contract items of work involved and no additional compensation will be allowed therefor.

The Engineer will retain an amount equal to 25 percent of the estimated value of the contract work performed during estimate periods in which the Contractor fails to conform to the provisions in this section "Water Pollution Control" as determined by the Engineer.

Retentions for failure to conform to the provisions in this section "Water Pollution Control" shall be in addition to the other retentions provided for in the contract. The amounts retained for failure of the Contractor to conform to the provisions in this section will be released for payment on the next monthly estimate for partial payment following the date that a WPCP has been implemented and maintained and water pollution is adequately controlled, as determined by the Engineer.

10-1.03 PRESERVATION OF PROPERTY

Attention is directed to Section 7-1.11, "Preservation of Property," of the Standard Specifications and these special provisions.

Existing trees, shrubs and other plants, that are not to be removed, and are injured or damaged by reason of the Contractor's operations, shall be replaced by the Contractor. The minimum size of tree replacement shall be No. 15 container and the minimum size of shrub replacement shall be No. 15 container. Replacement ground cover plants shall be from flats and shall be planted 300 mm on center. Replacement of Carpobrotus ground cover plants shall be from cuttings and shall be planted 300 mm on center. Replacement planting shall conform to the requirements in Section 20-4.07, "Replacement," of the Standard Specifications. The Contractor shall water replacement plants in conformance with the provisions in Section 20-4.06, "Watering," of the Standard Specifications.

Damaged or injured plants shall be removed and disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13 of the Standard Specifications. At the option of the Contractor, removed trees and shrubs may be reduced to chips. The chipped material shall be spread within the highway right of way at locations designated by the Engineer.

Replacement planting of injured or damaged trees, shrubs and other plants shall be completed not less than 20 working days prior to acceptance of the contract. Replacement plants shall be watered as necessary to maintain the plants in a healthy condition.

10-1.04 COOPERATION

Attention is directed to Section 7-1.14, "Cooperation," and Section 8-1.10, "Utility and Non-Highway Facilities," of the Standard Specifications and these special provisions.

It is anticipated that the following work by another contractor may be in progress adjacent to or within the limits of this project during progress of the work on this contract:

Contract No.	Type of Work	Limit of work
07-140804	Lighting and Sign Illumination	KP (23.36/29.76)
07-208034	Upgrade crash cushion	KP (25.12/26.4)
07-206024	Upgrade Guard rails	KP (28.48/131.2)
07-208024	Upgrade crash cushion	KP (36.48/131.5)
07-200904	Safety improvements	KP (39.0/131.6)

10-1.05 PROGRESS SCHEDULE (CRITICAL PATH METHOD)

The Contractor shall submit to the Engineer practicable critical path method (CPM) progress schedules in conformance with these special provisions. Whenever the term "schedule" is used in this section it shall mean CPM progress schedule.

Attention is directed to "Payments" of Section 5 of these special provisions.

The provisions in Section 8-1.04, "Progress Schedule," of the Standard Specifications shall not apply.

DEFINITIONS

The following definitions shall apply to this section:

- A. **ACTIVITY.**—A task, event or other project element on a schedule that contributes to completing the project. Activities have a description, start date, finish date, duration and one or more logic ties.
- B. **BASELINE SCHEDULE.**—The initial schedule representing the Contractor's work plan on the first working day of the project.
- C. **CONTRACT COMPLETION DATE.**—The current extended date for completion of the contract shown on the weekly statement of working days furnished by the Engineer in conformance with the provisions in Section 8-1.06, "Time of Completion," of the Standard Specifications.
- D. **CRITICAL PATH.**—The longest continuous chain of activities for the project that has the least amount of total float of all chains. In general, a delay on the critical path will extend the scheduled completion date.
- E. **CRITICAL PATH METHOD (CPM).**—A network based planning technique using activity durations and the relationships between activities to mathematically calculate a schedule for the entire project.
- F. **DATA DATE.**—The day after the date through which a schedule is current. Everything occurring earlier than the data date is "as-built" and everything on or after the data date is "planned."
- G. **EARLY COMPLETION TIME.**—The difference in time between an early scheduled completion date and the contract completion date.
- H. **FLOAT.**—The difference between the earliest and latest allowable start or finish times for an activity.
- I. **MILESTONE.**—An event activity that has zero duration and is typically used to represent the beginning or end of a certain stage of the project.
- J. **NARRATIVE REPORT.**—A document submitted with each schedule that discusses topics related to project progress and scheduling.
- K. **NEAR CRITICAL PATH.**—A chain of activities with total float exceeding that of the critical path but having no more than 10 working days of total float.
- L. **SCHEDULED COMPLETION DATE.**—The planned project finish date shown on the current accepted schedule.
- M. **STATE OWNED FLOAT ACTIVITY.**—The activity documenting time saved on the critical path by actions of the State. It is the last activity prior to the scheduled completion date.
- N. **TIME IMPACT ANALYSIS.**—A schedule and narrative report developed specifically to demonstrate what effect a proposed change or delay has on the current scheduled completion date.
- O. **TOTAL FLOAT.**—The amount of time that an activity or chain of activities can be delayed before extending the scheduled completion date.
- P. **UPDATE SCHEDULE.**—A current schedule developed from the baseline or subsequent schedule through regular monthly review to incorporate as-built progress and any planned changes.

GENERAL REQUIREMENTS

The Contractor shall submit to the Engineer baseline, monthly update and final update schedules, each consistent in all respects with the time and order of work requirements of the contract. The project work shall be executed in the sequence indicated on the current accepted schedule.

Schedules shall show the order in which the Contractor proposes to carry out the work with logical links between time-scaled work activities, and calculations made using the critical path method to determine the controlling operation or operations. The Contractor is responsible for assuring that all activity sequences are logical and that each schedule shows a coordinated plan for complete performance of the work.

The Contractor shall produce schedules using computer software and shall furnish compatible software for the Engineer's exclusive possession and use. The Contractor shall furnish network diagrams, narrative reports, tabular reports and schedule data as parts of each schedule submittal.

Schedules shall include, but not be limited to, activities that show the following that are applicable to the project:

- A. Project characteristics, salient features, or interfaces, including those with outside entities, that could affect time of completion.
- B. Project start date, scheduled completion date and other milestones.
- C. Work performed by the Contractor, subcontractors and suppliers.
- D. Submittal development, delivery, review and approval, including those from the Contractor, subcontractors and suppliers.
- E. Procurement, delivery, installation and testing of materials, plants and equipment.
- F. Testing and settlement periods.
- G. Utility notification and relocation.

- H. Erection and removal of falsework and shoring.
- I. Major traffic stage switches.
- J. Finishing roadway and final cleanup.
- K. State-owned float as the predecessor activity to the scheduled completion date.

Schedules shall have not less than 50 and not more than 500 activities, unless otherwise authorized by the Engineer. The number of activities shall be sufficient to assure adequate planning of the project, to permit monitoring and evaluation of progress, and to do an analysis of time impacts.

Schedule activities shall include the following:

- A. A clear and legible description.
- B. Start and finish dates.
- C. A duration of not less than one working day, except for event activities, and not more than 20 working days, unless otherwise authorized by the Engineer.
- D. At least one predecessor and one successor activity, except for project start and finish milestones.
- E. Required constraints.
- F. Codes for responsibility, stage, work shifts, location and contract pay item numbers.

The Contractor may show early completion time on any schedule provided that the requirements of the contract are met. Early completion time shall be considered a resource for the exclusive use of the Contractor. The Contractor may increase early completion time by improving production, reallocating resources to be more efficient, performing sequential activities concurrently or by completing activities earlier than planned. The Contractor may also submit for approval a cost reduction incentive proposal in conformance with the provisions in Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications that will reduce time of construction.

The Contractor may show a scheduled completion date that is later than the contract completion date on an update schedule, after the baseline schedule is accepted. The Contractor shall provide an explanation for a late scheduled completion date in the narrative report that is included with the schedule.

State-owned float shall be considered a resource for the exclusive use of the State. The Engineer may accrue State-owned float by the early completion of review of any type of required submittal when it saves time on the critical path. The Contractor shall prepare a time impact analysis, when requested by the Engineer, to determine the effect of the action in conformance with the provisions in "Time Impact Analysis" specified herein. The Engineer will document State-owned float by directing the Contractor to update the State-owned float activity on the next update schedule. The Contractor shall include a log of the action on the State-owned float activity and include a discussion of the action in the narrative report. The Engineer may use State-owned float to mitigate past, present or future State delays by offsetting potential time extensions for contract change orders.

The Engineer may adjust contract working days for ordered changes that affect the scheduled completion date, in conformance with the provisions in Section 4-1.03, "Changes," of the Standard Specifications. The Contractor shall prepare a time impact analysis to determine the effect of the change in conformance with the provisions in "Time Impact Analysis" specified herein, and shall include the impacts acceptable to the Engineer in the next update schedule. Changes that do not affect the controlling operation on the critical path will not be considered as the basis for a time adjustment. Changes that do affect the controlling operation on the critical path will be considered by the Engineer in decreasing time or granting an extension of time for completion of the contract. Time extensions will only be granted if the total float is absorbed and the scheduled completion date is delayed one or more working days because of the ordered change.

The Engineer's review and acceptance of schedules shall not waive any contract requirements and shall not relieve the Contractor of any obligation thereunder or responsibility for submitting complete and accurate information. Schedules that are rejected shall be corrected by the Contractor and resubmitted to the Engineer within 5 working days of notification by the Engineer, at which time a new review period of one week will begin.

Errors or omissions on schedules shall not relieve the Contractor from finishing all work within the time limit specified for completion of the contract. If, after a schedule has been accepted by the Engineer, either the Contractor or the Engineer discover that any aspect of the schedule has an error or omission, it shall be corrected by the Contractor on the next update schedule.

COMPUTER SOFTWARE

The Contractor shall submit to the Engineer for approval a description of proposed software before delivery. The software shall be the current version of Primavera SureTrak Project Manager for Windows, or equal, and shall be compatible with Windows NT (version 4.0) operating system. If software other than SureTrak is proposed, it shall be capable of generating files that can be imported into SureTrak.

The Contractor shall furnish schedule software and all original software instruction manuals to the Engineer with submittal of the baseline schedule. The furnished schedule software shall become the property of the State and will not be returned to the Contractor. The State will compensate the Contractor in conformance with the provisions in Section 4-1.03, "Extra Work," of the Standard Specifications for replacement of software which is damaged, lost or stolen after delivery to the Engineer.

The Contractor shall instruct the Engineer in the use of the software and provide software support until the contract is accepted. Within 20 working days of contract approval, the Contractor shall provide a commercial 8-hour training session for 2 Department employees in the use of the software at a location acceptable to the Engineer. It is recommended that the Contractor also send at least 2 employees to the same training session to facilitate development of similar knowledge and skills in the use of the software. If software other than SureTrak is furnished, then the training session shall be a total of 16-hours for each Department employee.

NETWORK DIAGRAMS, REPORTS AND DATA

The Contractor shall include the following for each schedule submittal:

- A. Two sets of originally plotted, time-scaled network diagrams.
- B. Two copies of a narrative report.
- C. Two copies of each of 3 sorts of the CPM software-generated tabular reports.
- D. One 1.44-megabyte 90 mm (3.5 inch) floppy diskette containing the schedule data.

The time-scaled network diagrams shall conform to the following:

- A. Show a continuous flow of information from left to right.
- B. Be based on early start and early finish dates of activities.
- C. Clearly show the primary paths of criticality using graphical presentation.
- D. Be prepared on E-size sheets, 860 mm x 1120 mm (34 inch x 44 inch).
- E. Include a title block and a timeline on each page.

The narrative report shall be organized in the following sequence with all applicable documents included:

- A. Contractor's transmittal letter.
- B. Work completed during the period.
- C. Identification of unusual conditions or restrictions regarding labor, equipment or material; including multiple shifts, 6-day work weeks, specified overtime or work at times other than regular days or hours.
- D. Description of the current critical path.
- E. Changes to the critical path and scheduled completion date since the last schedule submittal.
- F. Description of problem areas.
- G. Current and anticipated delays:
 - 1. Cause of delay.
 - 2. Impact of delay on other activities, milestones and completion dates.
 - 3. Corrective action and schedule adjustments to correct the delay.
- H. Pending items and status thereof:
 - 1. Permits
 - 2. Change orders
 - 3. Time adjustments
 - 4. Non-compliance notices
- I. Reasons for an early or late scheduled completion date in comparison to the contract completion date.

Tabular reports shall be software-generated and provide information for each activity included in the project schedule. Three different reports shall be sorted by (1) activity number, (2) early start and (3) total float. Tabular reports shall be 215 mm x 280 mm (8 1/2 inch x 11 inch) in size and shall include, as a minimum, the following applicable information:

- A. Data date
- B. Activity number and description

- C. Predecessor and successor activity numbers and descriptions
- D. Activity codes
- E. Scheduled, or actual and remaining durations (work days) for each activity
- F. Earliest start (calendar) date
- G. Earliest finish (calendar) date
- H. Actual start (calendar) date
- I. Actual finish (calendar) date
- J. Latest start (calendar) date
- K. Latest finish (calendar) date
- L. Free float (work days)
- M. Total float (work days)
- N. Percentage of activity complete and remaining duration for incomplete activities.
- O. Lags
- P. Required constraints

Schedule submittals will only be considered complete when all documents and data have been provided as described above.

PRE-CONSTRUCTION SCHEDULING CONFERENCE

The Contractor shall schedule and the Engineer will conduct a pre-construction scheduling conference with the Contractor's project manager and construction scheduler within 10 working days of the approval of the contract. At this meeting the Engineer will review the requirements of this section of the special provisions with the Contractor.

The Contractor shall submit a general time-scaled logic diagram displaying the major activities and sequence of planned operations and shall be prepared to discuss the proposed work plan and schedule methodology that comply with the requirements of these special provisions. If the Contractor proposes deviations to the construction staging of the project, then the general time-scaled logic diagram shall also display the deviations and resulting time impacts. The Contractor shall be prepared to discuss the proposal.

At this meeting, the Contractor shall additionally submit the alphanumeric coding structure and the activity identification system for labeling the work activities. To easily identify relationships, each activity description shall indicate its associated scope or location of work by including such terms as quantity of material, type of work, bridge number, station to station location, side of highway (such as left, right, northbound, southbound), lane number, shoulder, ramp name, ramp line descriptor or mainline.

The Engineer will review the logic diagram, coding structure, and activity identification system, and provide any required baseline schedule changes to the Contractor for implementation.

BASELINE SCHEDULE

Beginning the week following the pre-construction scheduling conference, the Contractor shall meet with the Engineer weekly until the baseline schedule is accepted by the Engineer to discuss schedule development and resolve schedule issues.

The Contractor shall submit to the Engineer a baseline schedule within 20 working days of approval of the contract. The Contractor shall allow 3 weeks for the Engineer's review after the baseline schedule and all support data are submitted. In addition, the baseline schedule submittal will not be considered complete until the computer software is delivered and installed for use in review of the schedule.

The baseline schedule shall include the entire scope of work and how the Contractor plans to complete all work contemplated. The baseline schedule shall show the activities that define the critical path. Multiple critical paths and near-critical paths shall be kept to a minimum. A total of not more than 50 percent of the baseline schedule activities shall be critical or near critical, unless otherwise authorized by the Engineer.

The baseline schedule shall not extend beyond the number of working days specified in these special provisions. The baseline schedule shall have a data date of the first working day of the contract and not include any completed work to date. The baseline schedule shall not attribute negative float or negative lag to any activity.

If the Contractor submits an early completion baseline schedule that shows contract completion in less than 85 percent of the working days specified in these special provisions, the baseline schedule shall be supplemented with resource allocations for every task activity and include time-scaled resource histograms. The resource allocations shall be shown to a level of detail that facilitates report generation based on labor crafts and equipment classes for the Contractor and subcontractors. The Contractor shall use average composite crews to display the labor loading of on-site construction activities. The Contractor shall optimize and level labor to reflect a reasonable plan for accomplishing the work of the contract and to assure that resources are not duplicated in concurrent activities. The time-scaled resource histograms shall show labor crafts and equipment classes to be utilized on the contract. The Engineer may review the baseline schedule activity resource allocations using Means Productivity Standards or equivalent to determine if the schedule is practicable.

UPDATE SCHEDULE

The Contractor shall submit an update schedule and meet with the Engineer to review contract progress, on or before the first day of each month, beginning one month after the baseline schedule is accepted. The Contractor shall allow 2 weeks for the Engineer's review after the update schedule and all support data are submitted, except that the review period shall not start until the previous month's required schedule is accepted. Update schedules that are not accepted or rejected within the review period will be considered accepted by the Engineer.

The update schedule shall have a data date of the twenty-first day of the month or other date established by the Engineer. The update schedule shall show the status of work actually completed to date and the work yet to be performed as planned. Actual activity start dates, percent complete and finish dates shall be shown as applicable. Durations for work that has been completed shall be shown on the update schedule as the work actually occurred, including Engineer submittal review and Contractor resubmittal times.

The Contractor may include modifications such as adding or deleting activities or changing activity constraints, durations or logic that do not (1) alter the critical path(s) or near critical path(s) or (2) extend the scheduled completion date compared to that shown on the current accepted schedule. The Contractor shall state in writing the reasons for any changes to planned work. If any proposed changes in planned work will result in (1) or (2) above, then the Contractor shall submit a time impact analysis as described herein.

TIME IMPACT ANALYSIS

The Contractor shall submit a written time impact analysis (TIA) to the Engineer with each request for adjustment of contract time, or when the Contractor or Engineer consider that an approved or anticipated change may impact the critical path or contract progress.

The TIA shall illustrate the impacts of each change or delay on the current scheduled completion date or internal milestone, as appropriate. The analysis shall use the accepted schedule that has a data date closest to and prior to the event. If the Engineer determines that the accepted schedule used does not appropriately represent the conditions prior to the event, the accepted schedule shall be updated to the day before the event being analyzed. The TIA shall include an impact schedule developed from incorporating the event into the accepted schedule by adding or deleting activities, or by changing durations or logic of existing activities. If the impact schedule shows that incorporating the event modifies the critical path and scheduled completion date of the accepted schedule, the difference between scheduled completion dates of the two schedules shall be equal to the adjustment of contract time. The Engineer may construct and utilize an appropriate project schedule or other recognized method to determine adjustments in contract time until the Contractor provides the TIA.

The Contractor shall submit a TIA in duplicate within 15 working days of receiving a written request for a TIA from the Engineer. The Contractor shall allow the Engineer 2 weeks after receipt to approve or reject the submitted TIA. All approved TIA schedule changes shall be shown on the next update schedule.

If a TIA submitted by the Contractor is rejected by the Engineer, the Contractor shall meet with the Engineer to discuss and resolve issues related to the TIA. If agreement is not reached, the Contractor will be allowed 15 days from the meeting with the Engineer to give notice in conformance with the provisions in Section 9-1.04, "Notice of Potential Claim," of the Standard Specifications. The Contractor shall only show actual as-built work, not unapproved changes related to the TIA, in subsequent update schedules. If agreement is reached at a later date, approved TIA schedule changes shall be shown on the next update schedule. The Engineer will withhold remaining payment on the schedule contract item if a TIA is requested by the Engineer and not submitted by the Contractor within 15 working days. The schedule item payment will resume on the next estimate after the requested TIA is submitted. No other contract payment will be retained regarding TIA submittals.

FINAL UPDATE SCHEDULE

The Contractor shall submit a final update, as-built schedule with actual start and finish dates for the activities, within 30 days after completion of contract work. The Contractor shall provide a written certificate with this submittal signed by the Contractor's project manager and an officer of the company stating, "To my knowledge and belief, the enclosed final update schedule reflects the actual start and finish dates of the actual activities for the project contained herein." An officer of the company may delegate in writing the authority to sign the certificate to a responsible manager.

RETENTION

The Department will retain an amount equal to 25 percent of the estimated value of the work performed during each estimate period in which the Contractor fails to submit an acceptable schedule conforming to the requirements of these special provisions as determined by the Engineer. Schedule retentions will be released for payment on the next monthly estimate for partial payment following the date that acceptable schedules are submitted to the Engineer or as otherwise specified herein. Upon completion of all contract work and submittal of the final update schedule and certification, any remaining retained funds associated with this section, "Progress Schedule (Critical Path Method)", will be released for

payment. Retentions held in conformance with this section shall be in addition to other retentions provided for in the contract. No interest will be due the Contractor on retention amounts.

PAYMENT

Progress schedule (critical path method) will be paid for at a lump sum price. The contract lump sum price paid for progress schedule (critical path method) shall include full compensation for furnishing all labor, material, tools, equipment, and incidentals, including computer software, and for doing all the work involved in preparing, furnishing, and updating schedules, and instructing and assisting the Engineer in the use of computer software, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Payments for the progress schedule (critical path method) contract item will be made progressively as follows:

- A. A total of 25 percent of the item amount or a total of 25 percent of the amount listed for progress schedule (critical path method) in "Payments" of Section 5 of these special provisions, whichever is less, will be paid upon achieving all of the following:
 - 1. Completion of 5 percent of all contract item work.
 - 2. Acceptance of all schedules and TIAs required to the time when 5 percent of all contract item work is complete.
 - 3. Delivery of schedule software to the Engineer.
 - 4. Completion of required schedule software training.
- B. A total of 50 percent of the item amount or a total of 50 percent of the amount listed for progress schedule (critical path method) in "Payments" of Section 5 of these special provisions, whichever is less, will be paid upon completion of 25 percent of all contract item work and acceptance of all schedules and TIAs required to the time when 25 percent of all contract item work is complete.
- C. A total of 75 percent of the item amount or a total of 75 percent of the amount listed for progress schedule (critical path method) in "Payments" of Section 5 of these special provisions, whichever is less, will be paid upon completion of 50 percent of all contract item work and acceptance of all schedules and TIAs required to the time when 50 percent of all contract item work is complete.
- D. A total of 100 percent of the item amount or a total of 100 percent of the amount listed for progress schedule (critical path method) in "Payments" of Section 5 of these special provisions, whichever is less, will be paid upon completion of all contract item work, acceptance of all schedules and TIAs required to the time when all contract item work is complete, and submittal of the certified final update schedule.

If the Contractor fails to complete any of the work or provide any of the schedules required by this section, the Engineer shall make an adjustment in compensation in conformance with the provisions in Section 4-1.03C, "Changes in Character of Work," of the Standard Specifications for the work not performed. Adjustments in compensation for schedules will not be made for any increased or decreased work ordered by the Engineer in furnishing schedules.

10-1.06 OVERHEAD

Overhead shall conform to these special provisions. The Contractor will be compensated for time-related overhead in conformance with these special provisions.

Attention is directed to "Force Account Payment" and "Progress Schedule (Critical Path Method)" of these special provisions.

The provisions in Section 9-1.08, "Adjustment of Overhead Costs," of the Standard Specifications shall not apply.

Time-related overhead shall consist of those overhead costs, including field and home office overhead, that are in proportion to the time required to complete the work. Time-related overhead shall not include costs that are not related to time, including but not limited to, mobilization, licenses, permits, and any other charges incurred only once during the contract.

Field office overhead expenses include time-related costs associated with the normal and recurring operations of the construction project, and shall not include costs directly attributable to any of the work of the contract. Such time-related costs include, but are not limited to, the salaries and benefits of project managers, general superintendents, field office managers and other field office staff assigned to the project, and rent, utilities, maintenance, security, supplies and equipment costs of the project field office.

Home office overhead or general and administrative expenses refer to the fixed costs of operating the Contractor's business. These costs include, but are not limited to, general administration, insurance, personnel and subcontract administration, purchasing, accounting, and project engineering and estimating. The rate of home office overhead shall exclude expenses specifically related to other contracts or other businesses of the Contractor, equipment coordination, material deliveries, and consultant and legal fees.

The quantity of time-related overhead to be paid will be measured by the working day, as specified in the Engineer's Estimate as WDAY. The estimated amount will be based on the number of working days, excluding any days for plant establishment, as specified in "Beginning of Work, Time of Completion and Liquidated Damages" of these special provisions. In the event an early completion progress schedule, as defined in "Progress Schedule (Critical Path Method)" of these special provisions, is submitted by the Contractor and approved by the Engineer, the quantity of time-related overhead eligible for payment will be based on the total number of working days as specified in "Beginning of Work, Time of Completion and Liquidated Damages" of these special provisions, rather than the Contractor's early completion progress schedule. The quantity of time-related overhead, as measured above, will be adjusted only as a result of suspensions and adjustments of time which revise the current contract completion date and which are also any of the following:

- A. Suspensions of work ordered in conformance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications, except:
 - 1. Suspensions ordered due to weather conditions being unfavorable for the suitable prosecution of the controlling operation or operations; or
 - 2. Suspensions ordered due to the failure on the part of the Contractor to carry out orders given, or to perform any provision of the contract; or
 - 3. Any other suspensions mutually agreed upon between the Engineer and the Contractor.
- B. Extensions of time granted by the State in conformance with the provisions in the fifth paragraph in Section 8-1.07, "Liquidated Damages," of the Standard Specifications; or
- C. Reductions in contract time set forth in approved contract change orders, in conformance with the provisions in Section 4-1.03, "Changes," of the Standard Specifications.

In the event a cost reduction proposal is submitted by the Contractor, and is subsequently approved by the Engineer, which provides for a reduction in contract time, the contract amount of time-related overhead associated with the reduction in contract time shall be considered as a net savings in the total cost of time-related overhead. The Contractor will be paid 50 percent of the estimated net savings of the time-related overhead, in conformance with the provisions in Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications.

If the quantity of time-related overhead, measured as specified in this special provision, exceeds 149 percent of the number of working days specified in the Engineer's Estimate, the Contractor shall, within 60 days of the Engineer's written request, submit to the Engineer an audit examination and report performed by an independent Certified Public Accountant of the Contractor's actual overhead costs. The independent Certified Public Accountant's audit examination shall be performed in conformance with the requirements of the American Institute of Certified Public Accountants Attestation Standards. The audit examination and report shall depict the Contractor's project and company-wide financial records and shall specify the actual overall average daily rates for both field and home office overhead for the entire duration of the project, and whether the costs have been properly allocated. The rates of field and home office overhead shall exclude all unallowable costs as determined in the Federal Acquisition Regulations, 48 CFR, Chapter 1, Part 31. The audit examination shall determine if the rates of field and home office overhead:

- A. are allowable in conformance with the requirements of the Federal Acquisition Regulations, 48 CFR, Chapter 1, Part 31;
- B. are adequately supported by reliable documentation; and
- C. related solely to the project under examination.

Upon the Engineer's written request, the Contractor shall make its financial records available for audit by the State for the purpose of verifying the actual rate of time-related overhead specified in the audit submitted by the Contractor. The actual rate of time-related overhead specified in the audit, submitted by the Contractor, will be subject to approval by the Engineer.

If the Engineer elects, or if requested in writing by the Contractor, contract item payments for time-related overhead, in excess of 149 percent of the number of working days designated in the Engineer's Estimate, will be adjusted to reflect the actual rate.

The cost of performing an audit examination and submitting the report, requested by the Engineer, will be borne equally by the State and the Contractor. The division of the cost will be made by determining the cost of providing an audit examination in conformance with the provisions of Section 9-1.03B, "Work performed by Special Forces or Other Special Services" of the Standard Specifications, and paying to the Contractor one-half of that cost.

The contract price paid per working day for time-related overhead shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in time-related overhead, complete in place, including all field and home office overhead costs incurred by the Contractor and by any joint venture partner, subcontractor, supplier or other party associated with the Contractor, and the Contractor's share of costs of audits of overhead costs requested by the Engineer, as specified in these special provisions, and as directed by the Engineer. The provisions in Sections 4-1.03B, "Increased or Decreased Quantities," 4-1.03C, "Changes in Character of the Work," of the Standard Specifications shall not apply to time-related overhead.

Full compensation for additional overhead costs involved in the performance of extra work at force account shall be considered as included in the markups specified in "Force Account Payment," of these special provisions.

Full compensation for additional overhead cost involved in performing additional contract item work that is not a controlling operation and for all overhead, other than the time-related overhead measured and paid for as specified in this section "Overhead", shall be considered as included in the various items of work involved, and no additional compensation will be allowed therefor.

For the purpose of making partial payments pursuant to the provisions in Section 9-1.06, "Partial Payments," of the Standard Specifications, the number of working days to be paid for time-related overhead in each monthly partial payment will be the number of working days, specified above to be measured for payment, that occurred during that monthly estimate period. The amount earned per working day for time-related overhead shall be either the contract item price, or 20 percent of the original total contract amount divided by the number of working days specified in "Beginning of Work, Time of Completion and Liquidated Damages," of these special provisions, whichever is the lesser.

After acceptance of the contract in conformance with the provisions in Section 7-1.17, "Acceptance of Contract," of the Standard Specifications, the amount of the total contract item price for time-related overhead not yet paid, will be included for payment in the first estimate made after acceptance of the contract in conformance with the provisions in Section 9-1.07, "Payment After Acceptance," of the Standard Specifications.

10-1.07 OBSTRUCTIONS

Attention is directed to Section 8-1.10, "Utility and Non-Highway Facilities," and Section 15, "Existing Highway Facilities," of the Standard Specifications and these special provisions.

The Contractor shall notify the Engineer and the appropriate regional notification center for operators of subsurface installations at least 2 working days, but not more than 14 calendar days, prior to performing any excavation or other work close to any underground pipeline, conduit, duct, wire or other structure. Regional notification centers include, but are not limited to, the following:

Notification Center	Telephone Number
Underground Service Alert-Northern California (USA)	1-800-642-2444 1-800-227-2600
Underground Service Alert-Southern California (USA)	1-800-422-4133 1-800-227-2600

10-1.08 DUST CONTROL

Dust control shall conform to the provisions in Section 10, "Dust Control," of the Standard Specifications.

10-1.09 MOBILIZATION

Mobilization shall conform to the provisions in Section 11, "Mobilization," of the Standard Specifications.

10-1.10 CONSTRUCTION AREA TRAFFIC CONTROL DEVICES

Flagging, signs, and all other traffic control devices furnished, installed, maintained, and removed when no longer required shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Category 1 traffic control devices are defined as those devices that are small and lightweight (less than 45 kg), and have been in common use for many years. The devices shall be known to be crashworthy by crash testing, crash testing of similar devices, or years of demonstrable safe performance. Category 1 traffic control devices include traffic cones, plastic drums, portable delineators, and channelizers.

If requested by the Engineer, the Contractor shall provide written self-certification for crashworthiness of Category 1 traffic control devices. Self-certification shall be provided by the manufacturer or Contractor and shall include the following: date, Federal Aid number (if applicable), expenditure authorization, district, county, route and kilometer post of project limits; company name of certifying vendor, street address, city, state and zip code; printed name, signature and title of

certifying person; and an indication of which Category 1 traffic control devices will be used on the project. The Contractor may obtain a standard form for self-certification from the Engineer.

Category 2 traffic control devices are defined as those items that are small and lightweight (less than 45 kg), that are not expected to produce significant vehicular velocity change, but may otherwise be potentially hazardous. Category 2 traffic control devices include: barricades and portable sign supports.

Category 2 devices purchased on or after October 1, 2000 shall be on the Federal Highway Administration (FHWA) Acceptable Crashworthy Category 2 Hardware for Work Zones list. This list is maintained by FHWA and can be located at the following internet address: <http://safety.fhwa.dot.gov/fourthlevel/hardware/listing.cfm?code=workzone>. The Department maintains a secondary list at the following internet address: <http://www.dot.ca.gov/hq/traffops/signtech/signdel/pdf/files.htm>.

Category 2 devices that have not received FHWA acceptance, and were purchased before October 1, 2000, may continue to be used until they complete their useful service life or until January 1, 2003, whichever comes first. Category 2 devices in use that have received FHWA acceptance shall be labeled with the FHWA acceptance letter number and the name of the manufacturer by the start of the project. The label shall be readable. After January 1, 2003, all Category 2 devices without a label shall not be used on the project.

If requested by the Engineer, the Contractor shall provide a written list of Category 2 devices to be used on the project at least 5 days prior to beginning any work using the devices. For each type of device, the list shall indicate the FHWA acceptance letter number and the name of the manufacturer.

Full compensation for providing self-certification for crashworthiness of Category 1 traffic control devices and for providing a list of Category 2 devices used on the project and labeling Category 2 devices as specified shall be considered as included in the prices paid for the various contract items of work requiring the use of the Category 1 or Category 2 traffic control devices and no additional compensation will be allowed therefor.

10-1.11 CONSTRUCTION AREA SIGNS

Construction area signs shall be furnished, installed, maintained, and removed when no longer required in conformance with the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Attention is directed to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions. Type II retroreflective sheeting shall not be used on construction area sign panels.

Attention is directed to "Construction Project Information Signs" of these special provisions regarding the number and type of construction project information signs to be furnished, erected, maintained, and removed and disposed of.

The Contractor shall notify the appropriate regional notification center for operators of subsurface installations at least 2 working days, but not more than 14 calendar days, prior to commencing excavation for construction area sign posts. The regional notification centers include, but are not limited to, the following:

Notification Center	Telephone Number
Underground Service Alert-Northern California (USA)	1-800-642-2444 1-800-227-2600
Underground Service Alert-Southern California (USA)	1-800-422-4133 1-800-227-2600

Excavations required to install construction area signs shall be performed by hand methods without the use of power equipment, except that power equipment may be used if it is determined there are no utility facilities in the area of the proposed post holes.

Sign substrates for stationary mounted construction area signs may be fabricated from fiberglass reinforced plastic as specified under "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

10-1.12 MAINTAINING TRAFFIC

Attention is directed to Sections 7-1.08, "Public Convenience," 7-1.09, "Public Safety," and 12, "Construction Area Traffic Control Devices," of the Standard Specifications and to the provisions in "Public Safety", of these special provisions and these special provisions. Nothing in these special provisions shall be construed as relieving the Contractor from the responsibilities specified in Section 7-1.09.

Lane closures shall conform to the provisions in section "Traffic Control System for Lane Closure" of these special provisions.

In addition to the provisions set forth in "Public Safety" of these special provisions, whenever work to be performed on the freeway traveled way (except installing loop detectors with a truck mounted attenuator (TMA) as a shadow vehicle and except the work of installing, maintaining and removing traffic control devices) is within 1.8 m of the adjacent traffic lane, the adjacent traffic lane shall be closed.

Personal vehicles of the Contractor's employees shall not be parked within the freeway right of way. The Contractor shall notify local authorities of the Contractor's intent to begin work at least 5 days before work is begun. The Contractor shall cooperate with local authorities relative to handling traffic through the area and shall make arrangements relative to keeping the working area clear of parked vehicles.

Whenever vehicles or equipment are parked on the freeway shoulder within 1.8 m of a traffic lane, the shoulder area shall be closed as shown on the plans.

Except as otherwise provided in these special provisions, freeway lanes, connectors, and ramps shall be closed only during the hours shown on Charts 1 through 54 included in this section "Maintaining Traffic." Except work required under Sections 7-1.08 and 7-1.09, work that interferes with public traffic shall be performed only during the hours shown for lane closures.

Traffic lanes, which are outside of through traffic lanes, as described in the Charts 2 through Chart 5 may be closed anytime the adjacent connector, or ramp is permitted to be closed in accordance with Charts 11 through 54.

When installing loop detector, the Contractor may close the freeway at one location in one direction at a time in conformance with the hours and requirements as shown on Charts 6 through 10. At other locations, the Contractor shall conform to the installation options as shown on the plans.

When work requires a connector to be closed within the limits of a freeway lane closure, all work on the connector shall be completed first. Work on portions of the freeway mainline necessary to insure a safe passageway for public traffic between the connector and the open lanes of the freeway mainline shall also be completed. The connector shall then be opened to public traffic before commencing work on the remaining portions of the freeway mainline.

No two consecutive on-ramps or consecutive off-ramps in the same direction of travel shall be closed at the same time.

If two or more consecutive on-ramps are permitted to be closed, the Contractor, at his expense, shall furnish and install special signs for entrance ramp closures (Sign SP-4) as directed by the Engineer.

When an off-ramp is closed, the Contractor shall furnish and erect, as directed by the Engineer, a special sign for exit ramp closures (Sign SP-3 or SP-5) as shown on the plans.

Special advance notice publicity signs (Sign SP-1), as shown on the plans shall be posted as directed by the Engineer, a minimum of 7 days prior to the actual ramp or connector closure. When a ramp is closed, public traffic shall be detoured as directed by the Engineer.

Furnishing, erecting, maintaining, and removing special portable freeway detour signs (sign SP-2) along the detour routes as directed by the Engineer shall be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Full compensation for furnishing, erecting, maintaining, and removing special signs for exit ramp closures (SP-3 or SP-5) and special advance notice publicity signs (SP-1), as shown on the plans or in these special provisions shall be considered as included in the contract lump sum price paid for traffic control system and no separate payment will be made therefor.

All aforementioned special signs shall become the property of the Contractor at the conclusion of this project and shall be removed from the worksite.

No work shall be permitted from 3 hours before to 2 hours following any special event or game at Rose Bowl.

Designated legal holidays are: January 1st, the third Monday in February, the last Monday in May, July 4th, the first Monday in September, November 11th, Thanksgiving Day, and December 25th. When a designated legal holiday falls on a Sunday, the following Monday shall be a designated legal holiday. When November 11th falls on a Saturday, the preceding Friday shall be a designated legal holiday.

Minor deviations from the requirements of this section concerning hours of work which do not significantly change the cost of the work may be permitted upon the written request of the Contractor, if in the opinion of the Engineer, public traffic will be better served and the work expedited. These deviations shall not be adopted by the Contractor until the Engineer has approved the deviations in writing. All other modifications will be made by contract change order.

Chart No. 1 Lane Requirements and Hours of Work																									
Location: N/B Route 2: From Route 5 to Newell Street on-ramp																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	1	1	1	1	
Fridays	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	1	1	1	1	
Saturdays	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Sundays	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Working day before designated legal holiday	1	1	1	1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Designated legal holidays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Legend: <div> <div>1</div> <div>Provide at least one through freeway lane open in direction of travel</div> </div> <div> <div>2</div> <div>Provide at least two through freeway lanes open in direction of travel</div> </div> <div> <div>X</div> <div>No lane closure permitted; no work permitted on Route 2 roadway</div> </div>																									
REMARKS: Number of Through Traffic Lanes - 3																									

Chart No. 2 Lane Requirements and Hours of Work																										
Location: N/B Route 2: From Riverside Drive to Route 134																										
FROM HOUR TO HOUR	a.m.												p.m.													
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
Mondays through Thursdays	1	1	1	1	1	1	2	3	3	2	2	2	3	3	3		X	X	X		3	2	2	1		
Fridays	1	1	1	1	1	1	2	3	3	2	2	2	3	3	3		X	X	X		3	3	2	2		
Saturdays	1	1	1	1	1	1	1	2	2	2	2	3	3	3	3	3	3	3	3	3	2	2	2	2		
Sundays	1	1	1	1	1	1	1	1	1	2	2	2	3	3	3	3	2	2	2	2	2	2	2	1		
Working day before designated legal holiday	1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Designated legal holidays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Legend: <div> <div>1</div> <div>Provide at least one through freeway lane open in direction of travel</div> </div> <div> <div>2</div> <div>Provide at least two through freeway lanes open in direction of travel</div> </div> <div> <div>3</div> <div>Provide at least three through freeway lanes open in direction of travel</div> </div> <div> <div></div> <div>No lane closure permitted; work permitted anywhere that does not require freeway lane closure</div> </div> <div> <div>X</div> <div>No lane closure permitted; no work permitted on Route 2 roadway</div> </div>																										
REMARKS: Number of Through Traffic Lanes - 4* Legend* - Traffic lane which is outside of the through traffic lanes and is delineated with a double line of pavement markers as shown on Standard Plan A20C, "Pavement Markers and Traffic Lines Detail 37 series," shall not be closed at same time as through traffic lanes, except as otherwise provided in this section.																										

Chart No. 3 Lane Requirements and Hours of Work																									
Location: N/B Route 2: Route 134 to Route 210																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	3		X		3	2	2	1	1	
Fridays	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	3		X		3	2	2	2	1	
Saturdays	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Sundays	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	
Working day before designated legal holiday	1	1	1	1	1	1	2	2	2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Designated legal holidays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Legend: <div> <div>1</div> <div>Provide at least one through freeway lane open in direction of travel</div> </div> <div> <div>2</div> <div>Provide at least two through freeway lanes open in direction of travel</div> </div> <div> <div>3</div> <div>Provide at least three through freeway lanes open in direction of travel</div> </div> <div> <div></div> <div>No lane closure permitted; work permitted anywhere that does not require freeway lane closure</div> </div> <div> <div>X</div> <div>No lane closure permitted; no work permitted on Route 2 roadway</div> </div>																									
REMARKS: Number of Through Traffic Lanes - 4* Legend* - Traffic lanes which are outside of the through traffic lanes and are delineated with a double line of pavement markers as shown on Standard Plan A20C, "Pavement Markers and Traffic Lines Detail 37 series," shall not be closed at same time as through traffic lanes, except as otherwise provided in this section.																									

Chart No. 4 Lane Requirements and Hours of Work																																			
Location: S/B Route 2: From Route 210 to Route 134																																			
FROM HOUR TO HOUR	a.m.												p.m.																						
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12										
Mondays through Thursdays	1	1	1	1	1	1	3	X	X	3	2	2	2	2	2	2	2	2	2	2	2	2	1	1											
Fridays	1	1	1	1	1	1	3	X	X	3	2	2	2	2	2	2	2	2	2	2	2	2	1	1											
Saturdays	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1											
Sundays	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1											
Working day before designated legal holiday	1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X											
Designated legal holidays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X											
<div>Legend:</div> <table><tr><td>1</td><td>Provide at least one through freeway lane open in direction of travel</td></tr><tr><td>2</td><td>Provide at least two through freeway lanes open in direction of travel</td></tr><tr><td>3</td><td>Provide at least three through freeway lanes open in direction of travel</td></tr><tr><td>X</td><td>No lane closure permitted; no work permitted on Route 2 roadway</td></tr></table>																												1	Provide at least one through freeway lane open in direction of travel	2	Provide at least two through freeway lanes open in direction of travel	3	Provide at least three through freeway lanes open in direction of travel	X	No lane closure permitted; no work permitted on Route 2 roadway
1	Provide at least one through freeway lane open in direction of travel																																		
2	Provide at least two through freeway lanes open in direction of travel																																		
3	Provide at least three through freeway lanes open in direction of travel																																		
X	No lane closure permitted; no work permitted on Route 2 roadway																																		
REMARKS: Number of Through Traffic Lanes - 4*																																			
Legend* - Traffic lane which is outside of the through traffic lanes and is delineated with a double line of pavement markers as shown on Standard Plan A20C, "Pavement Markers and Traffic Lines Detail 37 series," shall not be closed at same time as through traffic lanes, except as otherwise provided in this section.																																			

Chart No. 5 Lane Requirements and Hours of Work																										
Location: S/B Route 2: from Route 134 to Route 5																										
FROM HOUR TO HOUR	a.m.												p.m.													
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
Mondays through Thursdays	1	1	1	1	1	2		X	X		3	3	3	3	3	3	3	3	3	3	2	2	2	1		
Fridays	1	1	1	1	1	2		X	X		3	3	3	3	3	3	3	3	3	3	2	2	2	1		
Saturdays	1	1	1	1	1	1	1	2	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	1		
Sundays	1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3	2	2	2	1	1		
Working day before designated legal holiday	1	1	1	1	1	2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Designated legal holidays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Legend:																										
1	Provide at least one through freeway lane open in direction of travel																									
2	Provide at least two through freeway lanes open in direction of travel																									
3	Provide at least three through freeway lanes open in direction of travel																									
	No lane closure permitted; work permitted anywhere that does not require freeway lane closure																									
X	No lane closure permitted; no work permitted on Route 2 roadway																									
REMARKS: Number of Through Traffic Lanes - 4*																										
Legend* - Traffic lane which is outside of the through traffic lanes and is delineated with a double line of pavement markers as shown on Standard Plan A20C, "Pavement Markers and Traffic Lines Detail 37 series," shall not be closed at same time as through traffic lanes, except as otherwise provided in this section.																										

Chart No. 6																										
Complete Freeway Closure Lane Requirements and Hours of Work																										
Location: N/B Route 2: At Route 5																										
FROM HOUR TO HOUR	a.m.												p.m.													
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
Mondays through Thursdays	X	X	X	X	X	X	X				X	X	X								X	X	X	X		
Fridays	X	X	X	X	X	X	X				X	X	X								X	X	X	X		
Saturdays	X	X	X	X	X	X	X				X	X	X	X							X	X	X	X	X	
Sundays	X	X	X	X	X	X	X	X	X								X	X	X	X	X	X	X	X	X	
Working day before designated legal holiday	X	X	X	X	X	X	X																			
Designated legal holidays																										
Legend:																										
X	Freeway may be closed completely																									
	No complete freeway closure is allowed																									
REMARKS: Detour traffic to continue on Glendale Blvd.; east on Fletcher Dr. to the on-ramp to N/B Rte 2 Fwy. Close S/B Rte 5 Fwy to N/B Rte 2 Fwy connector; detour traffic as shown on Chart 15.																										

Chart No. 7																										
Complete Freeway Closure Lane Requirements and Hours of Work																										
Location: N/B Route 2: From Route 5 to San Fernando Road.																										
FROM HOUR TO HOUR	a.m.												p.m.													
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
Mondays through Thursdays	X	X	X	X	X	X																		X	X	
Fridays	X	X	X	X	X	X																			X	
Saturdays	X	X	X	X	X	X	X	X																	X	
Sundays	X	X	X	X	X	X	X	X	X	X														X	X	
Working day before designated legal holiday	X	X	X	X	X	X																				
Designated legal holidays																										
Legend:																										
X	Freeway may be closed completely																									
	No complete freeway closure is allowed																									
REMARKS: Detour traffic to exit at Riverside Dr. off-ramp; west on Newell St.; north on Riverside Dr.; east on Fletcher Dr. south on San Fernando Rd. to the on-ramp to N/B Rte 2 Fwy. Place a Portable Changeable Message Sign on the right shoulder of N/B Rte 2 Fwy 500 meters upstream of Glendale Blvd. with the message " FREEWAY / CLOSED / AHEAD - RTE 5 TO / SAN / FERNANDO". Close N/B Rte 5 to N/B Rte 2 connector, detour traffic as shown on Chart 11. Close S/B Rte 5 to N/B Rte 2 connector, detour traffic as shown on Chart 15. Close on-ramp from Newell St. to Fletcher Dr.																										

Chart No. 8 Complete Freeway Closure Lane Requirements and Hours of Work																									
Location: N/B Route 2: From San Fernando Road to Eagle Rock Boulevard																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X																			
Fridays	X	X	X	X	X	X																			
Saturdays		X	X	X	X	X	X																		
Sundays		X	X	X	X	X	X	X																	
Working day before designated legal holiday	X	X	X	X	X																				
Designated legal holidays																									
Legend: <div> <div>X</div> Freeway may be closed completely <div></div> No complete freeway closure is allowed </div>																									
REMARKS: Detour traffic to exit at San Fernando Rd. off-ramp; north on San Fernando Rd.; east on Fletcher Dr.; north on Eagle Rock Blvd. to the on-ramp to N/B Rte 2 Fwy. Place a Portable Changeable Message Sign on the right shoulder of N/B Rte 2 Fwy. 500 meters upstream of Riverside Dr. off-ramp with the message " FREEWAY / CLOSED / AHEAD - S FERENDO / TO EAGLE / ROCK ". Place a second Portable Changeable Message Sign on the N/B Rte 5 Fwy to N/B Rte 2 Fwy connector with the message " FREEWAY /CLOSED / AHEAD - S FERENDO / TO / E ROCK ". Close the San Fernando Rd. on-ramp to N/B Rte 2 Fwy.																									

Chart No. 9 Complete Freeway Closure Lane Requirements and Hours of Work																									
Location: S/B Route 2: From Verdugo Road to San Fernando Road																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X																				X
Fridays	X	X	X	X	X																				
Saturdays	X	X	X	X	X	X																			
Sundays	X	X	X	X	X	X	X																		X
Working day before designated legal holiday	X	X	X	X	X																				
Designated legal holidays																									
Legend: <div> <div>X</div> Freeway may be closed completely <div></div> No complete freeway closure is allowed </div>																									
REMARKS: Detour traffic to exit Verdugo Rd.; south Verdugo Rd. west on Eagle Rock Blvd.; south on Fletcher Dr.; east on San Fernando Rd. to the on-ramp to S/B Rte 2 Fwy. Place a Portable Changeable Message Sign on the right shoulder of S/B Rte 2 Fwy 500 meters upstream of the York Blvd. off-ramp with the message " FREEWAY / CLOSED / AHEAD - VERDUGO / TO SAN / FERNANDO " Close the Verdugo Rd. on-ramp to S/B Rte 2 Fwy.																									

Chart No. 10 Complete Freeway Closure Lane Requirements and Hours of Work																									
Location: S/B Route 2: San Fernando Road to Route 5																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X																				X
Fridays	X	X	X	X	X																				
Saturdays	X	X	X	X	X	X																			
Sundays	X	X	X	X	X	X	X																		X
Working day before designated legal holiday	X	X	X	X	X																				
Designated legal holidays																									
Legend:																									
X	Freeway may be closed completely																								
	No complete freeway closure is allowed																								
REMARKS: Detour traffic to exit San Fernando Rd.; north on San Fernando Rd. west on Fletcher Dr.; east on Riverside Dr. to the on-ramp to S/B Rte 2 Fwy. Place a Portable Changeable Message Sign on the right shoulder of S/B Rte 2 Fwy by Eastr Ave. OC with the message " FREEWAY / CLOSED / - AT / SAN / FERNANDO "																									

Chart No. 11 Connector Lane Requirements and Hours of Work																									
Location: N/B Route 5 to N/B Route 2																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X																			
Fridays	X	X	X	X	X	X																			
Saturdays	X	X	X	X	X	X	X	X																	
Sundays	X	X	X	X	X	X	X	X	X	X															X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Connector may be closed																								
	Work permitted that does not require connector lane closure																								
REMARKS: Detour traffic to continue on Rte 5 Fwy; exit at Glendale Blvd. off-ramp; north on Glendale Blvd.; east on San Fernando Rd. to the on-ramp to N/B Rte 2 Fwy. Place a Portable Changeable Message Sign on the right shoulder of N/B Rte 5 Fwy 500 meters upstream of the Stadium Way off-ramp with the message " NORTH 2/ EXIT / CLOSED " Place a second Portable Changeable Message Sign inside the connector closure with the message " NORTH 2 / EXIT / CLOSED - DETOUR/ USE / GLENDALE "																									

Chart No. 12 Connector Lane Requirements and Hours of Work																									
Location: N/B Route 5 to S/B Route 2																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Fridays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Connector may be closed																								
	Work permitted that does not require connector lane closure																								
REMARKS: Detour traffic to take N/B Rte 2 Fwy connector to exit at San Fernando Rd.; north to the on-ramp to the S/B Rte 2 Fwy. Place a Portable Changeable Message Sign on the right shoulder of N/B Rte 5 Fwy 500 meters upstream of the Stadium Way off-ramp with the message " SOUTH 2 / EXIT / CLOSED - USE N 2 TO / SAN -/ FERNANDO"																									

Chart No. 13 Connector Lane Requirements and Hours of Work																									
Location: S/B Route 5 to N/B Route 2																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Fridays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Connector may be closed																								
	Work permitted that does not require connector lane closure																								
REMARKS: Detour traffic to exit at Fletcher Dr. off-ramp; north on Fletcher Dr.; east on San Fernando Rd. to the on-ramp to N/B Rte 2 Fwy. Place a Portable Changeable Message Sign on the right shoulder of N/B Rte 5 Fwy 500 meters upstream of the Fletcher Dr. off-ramp with the message "NORTH 2 / EXIT / CLOSED - DETOUR / USE / FLETCHER"																									

Chart No. 14 Connector Lane Requirements and Hours of Work																									
Location: S/B Route 5 to S/B Route 2																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Fridays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Connector may be closed																								
	Work permitted that does not require connector lane closure																								
REMARKS: Detour traffic to exit at Fletcher Dr. off-ramp; south on Fletcher Dr.; continue south on Glendale Blvd. Place a Portable Changeable Message Sign on the right shoulder of S/B Rte 5 Fwy 500 meters upstream of the Fletcher Dr. off-ramp with the message " SOUTH 2 / EXIT / CLOSED - DETOUR / USE / FLETCHER "																									

Chart No. 15 Connector Lane Requirements and Hours of Work																									
Location: S/B Route 2 to N/B Route 5																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Fridays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Connector may be closed																								
	Work permitted that does not require connector lane closure																								
REMARKS: Detour traffic to exit at Fletcher Rd.; south on Fletcher Dr. to the on-ramp to N/B Rte 5 Fwy. Place a Portable Changeable Message Sign on the right shoulder of S/B Rte 2 Fwy 500 meters upstream of the Fletcher Dr. off-ramp with the message " NORTH 5 / EXIT / CLOSED - DETOUR / USE / FLETCHER "																									

Chart No. 16 Connector Lane Requirements and Hours of Work																										
Location: S/B Route 2 to Route 5																										
FROM HOUR TO HOUR	a.m.												p.m.													
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
Mondays through Thursdays	X	X	X	X	X																			X	X	
Fridays	X	X	X	X	X																			X	X	
Saturdays	X	X	X	X	X	X																			X	
Sundays	X	X	X	X	X	X	X																		X	
Working day before designated legal holiday	X	X	X	X	X																					
Designated legal holidays																										
Legend:																										
X	Connector may be closed																									
	Work permitted that does not require connector lane closure																									
REMARKS: Detour the N/B Rte 5 Fwy traffic as shown on Chart 13 and detour S/B traffic to exit at Fletcher Dr.; south on Fletcher Dr. west on Riverside Dr.; continue west on Stadium Way to the on-ramp to S/B Rte 5 Fwy. Place a Portable Changeable Message Sign on the right shoulder of S/B Rte 2 Fwy 500 meters upstream of the Fletcher Dr. off ramp with the message " ROUTE 5 / EXITS / CLOSED - DETOUR / USE / FLETCHER "																										

Chart No. 17 Connector Lane Requirements and Hours of Work																									
Location: N/B Route 2 to E/B Route 134																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X	X					X	X	X	X							X	X	X	X
Fridays	X	X	X	X	X	X	X					X	X	X	X							X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X	X																		
Designated legal holidays																									
Legend:																									
X	Connector may be closed																								
	Work permitted that does not require connector lane closure																								
REMARKS: Detour traffic to continue on N/B Rte 2 Fwy; exit at Holly Dr. off-ramp; west on Holly Dr.; south on Harvey Dr. to the on-ramp to E/B Rte 134 Fwy. Place a Portable Changeable Message Sign on the right shoulder of N/B Rte 2 Fwy by Round Top UC with the message " EAST 134 / EXIT / CLOSED - DETOUR / USE / HOLLY DR "																									

Chart No. 18 Connector Lane Requirements and Hours of Work																									
Location: N/B Route 2 to W/B Route 134																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Fridays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Connector may be closed																								
	Work permitted that does not require connector lane closure																								
REMARKS: Detour traffic to continue on N/B Rte 2 Fwy; exit at Holly Dr. off-ramp; west on Holly Dr.; south on Harvey Dr. to the on-ramp to W/B Rte 134 Fwy. Place a Portable Changeable Message Sign on the right shoulder of N/B Rte 2 Fwy by Round Top UC with the message " WEST 134 / EXIT / CLOSED - DETOUR / USE / HOLLY DR "																									

Chart No. 19 Connector Lane Requirements and Hours of Work																									
Location: S/B Route 2 to W/B Route 134																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X							X	X	X	X					X	X	X	X	X
Fridays	X	X	X	X	X	X							X	X	X	X					X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X												X	X	X	X	
Sundays	X	X	X	X	X	X	X	X	X	X	X	X									X	X	X	X	
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Connector may be closed																								
	Work permitted that does not require connector lane closure																								
REMARKS: Detour traffic to exit at Holly Dr. off-ramp; west on Holly Dr.; south on Harvey Dr. to the on-ramp to W/B Rte 134 Fwy. Place a Portable Changeable Message Sign on the right shoulder of S/B Rte 2 Fwy 500 meters upstream of Chevy Chase Dr. with the message " WEST 134 / EXIT / CLOSED - DETOUR / USE / HOLLY DR "																									

Chart No. 20																									
Connector Lane Requirements and Hours of Work																									
Location: S/B Route 2 to Route 134																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X																X	X	X	X
Fridays	X	X	X	X	X	X																X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X													X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X											X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Connector may be closed																								
	Work permitted that does not require connector lane closure																								
REMARKS: Detour traffic to exit at Holly Dr. off-ramp; west on Holly Dr.; south on Harvey Dr. to the on-ramp to E/B Rte 134 Fwy or W/B Rte 134 Fwy. Place a Portable Changeable Message Sign on the right shoulder of S/B Rte 2 Fwy 500 meters upstream of Chevy Chase Dr. UC with the message " ROUTE 134 / EXITS / CLOSED - DETOUR / USE / HOLLY DR "																									

Chart No. 21																									
Connector Lane Requirements and Hours of Work																									
Location: W/B Route 134 to N/B Route 2																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Fridays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Connector may be closed																								
	Work permitted that does not require connector lane closure																								
REMARKS: Detour traffic to continue on W/B Rte 134 Fwy; exit at Harvey Dr. off-ramp; north on Harvey Dr.; east on Holly Dr. to the on-ramp to N/B Rte 2 Fwy. Place a Portable Changeable Message Sign on the right shoulder of W/B Rte 134 Fwy 500 meters upstream of the W/B Rte 134 / Rte 2 connector with the message " NORTH 2 / EXIT / CLOSED - DETOUR / USE / HARVEY DR"																									

Chart No. 22																									
Connector Lane Requirements and Hours of Work																									
Location: W/B Route 134 to Route 2																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X							X	X	X	X	
Fridays	X	X	X	X	X	X					X	X	X	X							X	X	X	X	
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X									X	X	X	X	
Sundays	X	X	X	X	X	X	X	X	X	X	X	X									X	X	X	X	
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Connector may be closed																								
	Work permitted that does not require connector lane closure																								
REMARKS: Detour traffic to continue on W/B Rte 134 Fwy; exit at Harvey Dr. off-ramp; north on Harvey Dr.; east on Holly Dr. to the on-ramp to N/B Rte 2 Fwy or S/B Rte 2 Fwy. Place a Portable Changeable Message Sign on the right shoulder of W/B Rte 134 Fwy 500 meters upstream of the W/B Rte 134 / Rte 2 connector with the message " NORTH 2 / EXIT / CLOSED - DETOUR / USE / HARVEY DR"																									

Chart No. 23																									
Connector Lane Requirements and Hours of Work																									
Location: E/B Route 134 to S/B Route 2																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X								X	X	X	
Fridays	X	X	X	X	X	X					X	X	X	X								X	X	X	
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Connector may be closed																								
	Work permitted that does not require connector lane closure																								
REMARKS: Detour traffic to continue on E/B Rte 134 Fwy and exit at Harvey Dr. off-ramp; north on Harvey Dr.; east on Holly Dr. to the on- ramp to S/B Rte 2 Fwy. Place a Portable Changeable Message Sign on the right shoulder of E/B Rte 134 Fwy 500 meters upstream of the Glendale Ave. off-ramp with the message " ROUTE 2 / EXITS / CLOSED - DETOUR / USE / HARVEY DR "																									

Chart No. 24																									
Connector Lane Requirements and Hours of Work																									
Location: E/B Route 134 to Route 2																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X																		X	X
Fridays	X	X	X	X	X	X																		X	X
Saturdays	X	X	X	X	X	X	X	X	X													X	X	X	
Sundays	X	X	X	X	X	X	X	X	X	X												X	X	X	
Working day before designated legal holiday	X	X	X	X	X	X	X																		
Designated legal holidays																									
Legend:																									
X	Connector may be closed																								
	Work permitted that does not require connector lane closure																								
REMARKS: Detour traffic to continue on E/B Rte 134 Fwy and exit at Harvey Dr. off-ramp; north on Harvey Dr.; east on Holly Dr. to the on-ramp to N/B Rte 2 Fwy, or to the on- ramp to S/B Rte 2 Fwy. Place a Portable Changeable Message Sign on the right shoulder of E/B Rte 134 Fwy 500 meters upstream of the Glendale Ave. off-ramp with the message " ROUTE 2 / EXITS / CLOSED - DETOUR / USE / HARVEY DR "																									

Chart No. 25																									
Connector Lane Requirements and Hours of Work																									
Location: N/B Route 2 to E/B Route 210																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Fridays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Connector may be closed																								
	Work permitted that does not require connector lane closure																								
REMARKS: Detour traffic to exit at Verdugo Blvd. off-ramp; west on Verdugo Blvd.; north on Montrose Ave.; north on Ocean View Blvd. to the on-ramp to the E/B Rte 210 Fwy. Place a Portable Changeable Message Sign on the right shoulder of N/B Rte 2 Fwy 500 meters upstream of the Mountain St. off-ramp with the message " EAST 210 / EXIT / CLOSED - DETOUR / USE / VERDUGO "																									

Chart No. 26 Connector Lane Requirements and Hours of Work																									
Location: N/B Route 2 to W/B Route 210																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X								X	X	X	X					X	X	X	X	X
Fridays	X	X	X	X	X								X	X	X	X					X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X											X	X	X	X	X	
Sundays	X	X	X	X	X	X	X	X	X											X	X	X	X	X	
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Connector may be closed																								
	Work permitted that does not require connector lane closure																								
REMARKS: Detour traffic to exit at Verdugo Blvd. off-ramp; west on Verdugo Blvd.; north on Montrose Ave.; north on Ocean View Blvd. to the on-ramp to the W/B Rte 210 Fwy. Place a Portable Changeable Message Sign on the right shoulder of N/B Rte 2 Fwy by Fern Ln. UC with the message " WEST 210 / EXIT / CLOSED - DETOUR / USE / VERDUGO "																									

Chart No. 27 Ramp Lane Requirements and Hours of Work																									
Location: N/B Route 2: Newell Street on-ramp																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Fridays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Ramp may be closed																								
	Work permitted anywhere that does not require ramp lane closure																								
REMARKS:																									

Chart No. 28																									
Ramp Lane Requirements and Hours of Work																									
Location: S/B Route 2: Riverside Dr. on-ramp																									
	a.m.												p.m.												
FROM HOUR TO HOUR	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Fridays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend: <div style="display: flex; border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px; display: flex; align-items: center; justify-content: center;">X</div> Ramp may be closed </div> <div style="display: flex; border: 1px solid black; padding: 5px; margin-top: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px;"></div> Work permitted anywhere that does not require ramp lane closure </div>																									
REMARKS:																									

Chart No. 29																									
Ramp Lane Requirements and Hours of Work																									
Location: N/B Route 2: Fletcher Drive on-ramp																									
	a.m.												p.m.												
FROM HOUR TO HOUR	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X	X							X	X	X	X
Fridays	X	X	X	X	X	X					X	X	X	X	X							X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X									X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X									X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend: <div style="display: flex; border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px; display: flex; align-items: center; justify-content: center;">X</div> Ramp may be closed </div> <div style="display: flex; border: 1px solid black; padding: 5px; margin-top: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px;"></div> Work permitted anywhere that does not require ramp lane closure </div>																									
REMARKS:																									

Chart No. 30
Ramp Lane Requirements and Hours of Work

Location: S/B Route 2: Fletcher Drive off-ramp

[illegible]

Legend:

X	Ramp may be closed
---	--------------------

Work permitted anywhere that does not require ramp lane closure

REMARKS:

Chart No. 31
Ramp Lane Requirements and Hours of Work

Location: N/B Route 2: San Fernando Road off-ramp

[illegible]

Legend:

X	Ramp may be closed
---	--------------------

Work permitted anywhere that does not require ramp lane closure

REMARKS:

Chart No. 32																									
Ramp Lane Requirements and Hours of Work																									
Location: N/B Route 2: San Fernando Road on-ramp																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X	X						X	X	X	X	X
Fridays	X	X	X	X	X	X					X	X	X	X	X						X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X									X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X									X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend: <div style="display: flex; border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px; display: flex; align-items: center; justify-content: center;">X</div> Ramp may be closed </div> <div style="display: flex; border: 1px solid black; padding: 5px; margin-top: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px;"></div> Work permitted anywhere that does not require ramp lane closure </div>																									
REMARKS:																									

Chart No. 33																									
Ramp Lane Requirements and Hours of Work																									
Location: S/B Route 2: San Fernando Road off-ramp																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X	X						X	X	X	X	X
Fridays	X	X	X	X	X	X					X	X	X	X	X						X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X									X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X									X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend: <div style="display: flex; border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px; display: flex; align-items: center; justify-content: center;">X</div> Ramp may be closed </div> <div style="display: flex; border: 1px solid black; padding: 5px; margin-top: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px;"></div> Work permitted anywhere that does not require ramp lane closure </div>																									
REMARKS:																									

Chart No. 34																										
Ramp Lane Requirements and Hours of Work																										
Location: S/B Route 2: San Fernando Road on-ramp																										
FROM HOUR TO HOUR	a.m.											p.m.														
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9		10	11	12
Mondays through Thursdays	X	X	X	X	X	X																	X	X	X	
Fridays	X	X	X	X	X	X																	X	X	X	
Saturdays	X	X	X	X	X	X	X																X	X	X	
Sundays	X	X	X	X	X	X	X	X	X													X	X	X	X	
Working day before designated legal holiday	X	X	X	X	X	X																				
Designated legal holidays																										
Legend: <div style="display: flex; border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px; display: flex; align-items: center; justify-content: center;">X</div> Ramp may be closed </div> <div style="display: flex; border: 1px solid black; padding: 5px; margin-top: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px;"></div> Work permitted anywhere that does not require ramp lane closure </div>																										
REMARKS:																										

Chart No. 35																										
Ramp Lane Requirements and Hours of Work																										
Location: N/B Route 2: Eagle Rock Boulevard off-ramp																										
FROM HOUR TO HOUR	a.m.											p.m.														
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9		10	11	12
Mondays through Thursdays	X	X	X	X	X	X																			X	
Fridays	X	X	X	X	X	X																				
Saturdays	X	X	X	X	X	X	X																			
Sundays	X	X	X	X	X	X	X	X																	X	
Working day before designated legal holiday	X	X	X	X	X	X																				
Designated legal holidays																										
Legend: <div style="display: flex; border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px; display: flex; align-items: center; justify-content: center;">X</div> Ramp may be closed </div> <div style="display: flex; border: 1px solid black; padding: 5px; margin-top: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px;"></div> Work permitted anywhere that does not require ramp lane closure </div>																										
REMARKS:																										

Chart No. 36																									
Ramp Lane Requirements and Hours of Work																									
Location: N/B Route 2: Eagle Rock Boulevard on-ramp																									
	a.m.												p.m.												
FROM HOUR TO HOUR	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Fridays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Ramp may be closed																								
	Work permitted anywhere that does not require ramp lane closure																								
REMARKS:																									

Chart No. 37																									
Ramp Lane Requirements and Hours of Work																									
Location: S/B Route 2: Verdugo Road off-ramp																									
	a.m.												p.m.												
FROM HOUR TO HOUR	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Fridays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Ramp may be closed																								
	Work permitted anywhere that does not require ramp lane closure																								
REMARKS:																									

Chart No. 38																									
Ramp Lane Requirements and Hours of Work																									
Location: S/B Route 2: Verdugo Road on-ramp																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X																			X	X
Fridays	X	X	X	X	X																				X
Saturdays	X	X	X	X	X	X	X																		X
Sundays	X	X	X	X	X	X	X	X															X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend: <div style="display: flex; border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px; text-align: center; line-height: 20px;">X</div> Ramp may be closed </div> <div style="display: flex; border: 1px solid black; padding: 5px; margin-top: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px;"></div> Work permitted anywhere that does not require ramp lane closure </div>																									
REMARKS:																									

Chart No. 39																									
Ramp Lane Requirements and Hours of Work																									
Location: N/B Route 2: York Boulevard on-ramp																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X				X	X	X	X	X						X	X	X	X	X	X
Fridays	X	X	X	X	X	X				X	X	X	X	X						X	X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend: <div style="display: flex; border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px; text-align: center; line-height: 20px;">X</div> Ramp may be closed </div> <div style="display: flex; border: 1px solid black; padding: 5px; margin-top: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px;"></div> Work permitted anywhere that does not require ramp lane closure </div>																									
REMARKS:																									

Chart No. 40																									
Ramp Lane Requirements and Hours of Work																									
Location: S/B Route 2: York Boulevard off-ramp																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X	X	X							X	X	X
Fridays	X	X	X	X	X	X					X	X	X	X	X	X							X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X										X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X										X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Ramp may be closed																								
	Work permitted anywhere that does not require ramp lane closure																								
REMARKS:																									

Chart No. 41																									
Ramp Lane Requirements and Hours of Work																									
Location: N/B Route 2: Colorado Boulevard off-ramp																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X																			X
Fridays	X	X	X	X	X	X																			X
Saturdays	X	X	X	X	X	X	X	X	X																
Sundays	X	X	X	X	X	X	X	X	X	X															
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Ramp may be closed																								
	Work permitted anywhere that does not require ramp lane closure																								
REMARKS:																									

Chart No. 42																									
Ramp Lane Requirements and Hours of Work																									
Location: S/B Route 2: Colorado Boulevard on-ramp																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X																		X	X
Fridays	X	X	X	X	X	X																		X	X
Saturdays	X	X	X	X	X	X	X	X															X	X	X
Sundays	X	X	X	X	X	X	X	X	X														X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend: <div style="display: flex; border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px; display: flex; align-items: center; justify-content: center;">X</div> Ramp may be closed </div> <div style="display: flex; border: 1px solid black; padding: 5px; margin-top: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px;"></div> Work permitted anywhere that does not require ramp lane closure </div>																									
REMARKS:																									

Chart No. 43																									
Ramp Lane Requirements and Hours of Work																									
Location: N/B Route 2: Holly Drive off-ramp																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X			X	X	X	X	X	X	X					X	X	X	X	X	
Fridays	X	X	X	X	X	X			X	X	X	X	X	X	X					X	X	X	X	X	
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X								X	X	X	X	X	
Sundays	X	X	X	X	X	X	X	X	X	X	X	X								X	X	X	X	X	
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend: <div style="display: flex; border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px; display: flex; align-items: center; justify-content: center;">X</div> Ramp may be closed </div> <div style="display: flex; border: 1px solid black; padding: 5px; margin-top: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px;"></div> Work permitted anywhere that does not require ramp lane closure </div>																									
REMARKS:																									

Chart No. 44																									
Ramp Lane Requirements and Hours of Work																									
Location: N/B Route 2: Holly Drive on-ramp																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X			X	X	X	X	X	X	X					X	X	X	X	X	
Fridays	X	X	X	X	X	X			X	X	X	X	X	X	X					X	X	X	X	X	
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Ramp may be closed																								
	Work permitted anywhere that does not require ramp lane closure																								
REMARKS:																									

Chart No. 45																									
Ramp Lane Requirements and Hours of Work																									
Location: S/B Route 2: Holly Drive off-ramp																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X	X						X	X	X	X	X
Fridays	X	X	X	X	X	X					X	X	X	X	X						X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Ramp may be closed																								
	Work permitted anywhere that does not require ramp lane closure																								
REMARKS:																									

Chart No. 46																									
Ramp Lane Requirements and Hours of Work																									
Location: S/B Route 2: Holly Drive on-ramp																									
	a.m.												p.m.												
FROM HOUR TO HOUR	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Fridays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X									X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X									X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend: <div style="display: flex; border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px; display: flex; align-items: center; justify-content: center;">X</div> Ramp may be closed </div> <div style="display: flex; border: 1px solid black; padding: 5px; margin-top: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px;"></div> Work permitted anywhere that does not require ramp lane closure </div>																									
REMARKS:																									

Chart No. 47																									
Ramp Lane Requirements and Hours of Work																									
Location: N/B Route 2: Mountain Street off-ramp																									
	a.m.												p.m.												
FROM HOUR TO HOUR	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X	X	X								X	X
Fridays	X	X	X	X	X	X					X	X	X	X	X	X								X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X												X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X												X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend: <div style="display: flex; border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px; display: flex; align-items: center; justify-content: center;">X</div> Ramp may be closed </div> <div style="display: flex; border: 1px solid black; padding: 5px; margin-top: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px;"></div> Work permitted anywhere that does not require ramp lane closure </div>																									
REMARKS:																									

Chart No. 48																									
Ramp Lane Requirements and Hours of Work																									
Location: N/B Route 2: Mountain Street on-ramp																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X	X									X	X
Fridays	X	X	X	X	X	X					X	X	X	X	X									X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X										X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X										X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Ramp may be closed																								
	Work permitted anywhere that does not require ramp lane closure																								
REMARKS:																									

Chart No. 49																									
Ramp Lane Requirements and Hours of Work																									
Location: S/B Route 2: Mountain Street off-ramp																									
FROM HOUR TO HOUR	a.m.												p.m.												
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Fridays	X	X	X	X	X	X					X	X	X	X	X	X					X	X	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X	X	X	X									X	X	X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X	X	X									X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend:																									
X	Ramp may be closed																								
	Work permitted anywhere that does not require ramp lane closure																								
REMARKS:																									

Chart No. 50																									
Ramp Lane Requirements and Hours of Work																									
Location: S/B Route 2: Mountain Street on-ramp																									
	a.m.												p.m.												
FROM HOUR TO HOUR	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X																X	X	X	X	X
Fridays	X	X	X	X	X																X	X	X	X	X
Saturdays	X	X	X	X	X	X	X							X	X	X	X	X	X	X	X	X	X	X	X
Sundays	X	X	X	X	X	X	X							X	X	X	X	X	X	X	X	X	X	X	X
Working day before designated legal holiday	X	X	X	X	X																				
Designated legal holidays																									
Legend: <div style="display: flex; border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px; display: flex; align-items: center; justify-content: center;">X</div> Ramp may be closed </div> <div style="display: flex; border: 1px solid black; padding: 5px; margin-top: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px;"></div> Work permitted anywhere that does not require ramp lane closure </div>																									
REMARKS:																									

Chart No. 51																									
Ramp Lane Requirements and Hours of Work																									
Location: N/B Route 2: Verdugo Boulevard off-ramp																									
	a.m.												p.m.												
FROM HOUR TO HOUR	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X																X	X	X	X
Fridays	X	X	X	X	X	X																	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X														X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X												X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend: <div style="display: flex; border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px; display: flex; align-items: center; justify-content: center;">X</div> Ramp may be closed </div> <div style="display: flex; border: 1px solid black; padding: 5px; margin-top: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px;"></div> Work permitted anywhere that does not require ramp lane closure </div>																									
REMARKS:																									

Chart No. 52																									
Ramp Lane Requirements and Hours of Work																									
Location: S/B Route 2: Verdugo Boulevard on-ramp																									
	a.m.												p.m.												
FROM HOUR TO HOUR	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X																X	X	X	X
Fridays	X	X	X	X	X	X																	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X														X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X												X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend: <div style="display: flex; border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px; display: flex; align-items: center; justify-content: center;">X</div> Ramp may be closed </div> <div style="display: flex; border: 1px solid black; padding: 5px; margin-top: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px;"></div> Work permitted anywhere that does not require ramp lane closure </div>																									
REMARKS:																									

Chart No. 53																									
Ramp Lane Requirements and Hours of Work																									
Location: N/B Route 2: Foothill Boulevard off-ramp																									
	a.m.												p.m.												
FROM HOUR TO HOUR	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Mondays through Thursdays	X	X	X	X	X	X																X	X	X	X
Fridays	X	X	X	X	X	X																	X	X	X
Saturdays	X	X	X	X	X	X	X	X	X														X	X	X
Sundays	X	X	X	X	X	X	X	X	X	X												X	X	X	X
Working day before designated legal holiday	X	X	X	X	X	X																			
Designated legal holidays																									
Legend: <div style="display: flex; border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px; display: flex; align-items: center; justify-content: center;">X</div> Ramp may be closed </div> <div style="display: flex; border: 1px solid black; padding: 5px; margin-top: 5px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 10px;"></div> Work permitted anywhere that does not require ramp lane closure </div>																									
REMARKS:																									

Chart No. 54 Ramp Lane Requirements and Hours of Work																												
Location: S/B Route 2: Foothill Boulevard on-ramp																												
FROM HOUR TO HOUR	a.m.												p.m.															
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12			
Mondays through Thursdays	X	X	X	X	X	X																X	X	X	X			
Fridays	X	X	X	X	X	X																	X	X	X			
Saturdays	X	X	X	X	X	X	X	X	X														X	X	X			
Sundays	X	X	X	X	X	X	X	X	X	X												X	X	X	X			
Working day before designated legal holiday	X	X	X	X	X	X																						
Designated legal holidays																												
Legend: <table border="1"> <tr> <td>X</td> <td>Ramp may be closed</td> </tr> <tr> <td></td> <td>Work permitted anywhere that does not require ramp lane closure</td> </tr> </table>																									X	Ramp may be closed		Work permitted anywhere that does not require ramp lane closure
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REMARKS:																												

10-1.13 CLOSURE REQUIREMENTS AND CONDITIONS

Lane closures shall conform to the provisions in "Maintaining Traffic" of these special provisions and these special provisions.

The term closure, as used herein, is defined as the closure of a traffic lane or lanes, including ramp or connector lanes, within a single traffic control system.

CLOSURE SCHEDULE

By noon Monday, the Contractor shall submit a written schedule of planned closures for the following week period, defined as Friday noon through the following Friday noon.

The Closure Schedule shall show the locations and times when the proposed closures are to be in effect. The Contractor shall use the Closure Schedule request forms furnished by the Engineer. Closure Schedules submitted to the Engineer with incomplete, unintelligible or inaccurate information will be returned for correction and resubmittal. The Contractor will be notified of disapproved closures or closures that require coordination with other parties as a condition of approval.

Amendments to the Closure Schedule, including adding additional closures, shall be submitted to the Engineer, in writing, at least 3 working days in advance of a planned closure. Approval of amendments to the Closure Schedule will be at the discretion of the Engineer.

The Contractor shall confirm, in writing, all scheduled closures by no later than 8:00 a.m. 3 working days prior to the date on which the closure is to be made. Approval or denial of scheduled closures will be made no later than 4:00 p.m. 2 working days prior to the date on which the closure is to be made. Closures not confirmed or approved will not be allowed.

Confirmed closures that are cancelled due to unsuitable weather may be rescheduled at the discretion of the Engineer for the following working day.

CONTINGENCY PLAN

The Contractor shall prepare a contingency plan for reopening closures to public traffic. The Contractor shall submit the contingency plan for a given operation to the Engineer within one working day of the Engineer's request.

LATE REOPENING OF CLOSURES

If a closure is not reopened to public traffic by the specified time, work shall be suspended in conformance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications. The Contractor shall not make any further closures until the Engineer has accepted a work plan, submitted by the Contractor, that will insure that future closures will be reopened to public traffic at the specified time. The Engineer will have 2 working days to accept or reject the Contractor's proposed work plan. The Contractor will not be entitled to any compensation for the suspension of work resulting from the late reopening of closures.

For each 10 minute interval, or fraction thereof past the time specified to reopen the closure, the Department will deduct \$5,400 per interval from moneys due or that may become due the Contractor under the contract.

COMPENSATION

The Contractor shall notify the Engineer of any delay in the Contractor's operations due to the following conditions, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of those conditions, and the Contractor's loss due to that delay could not have been avoided by rescheduling the affected closure or by judicious handling of forces, equipment and plant, the delay will be considered a right of way delay within the meaning of Section 8-1.09, "Right of Way Delays," and compensation for the delay will be determined in conformance with the provisions in Section 8-1.09:

- A. The Contractor's proposed Closure Schedule is denied and his planned closures are within the time frame allowed for closures in "Maintaining Traffic" of these special provisions, except that the Contractor will not be entitled to any compensation for amendments to the Closure Schedule that are not approved.
- B. The Contractor is denied a confirmed closure.

Should the Engineer direct the Contractor to remove a closure prior to the time designated in the approved Closure Schedule, any delay to the Contractor's schedule due to removal of the closure will be considered a right of way delay within the meaning of Section 8-1.09, "Right of Way Delays," and compensation for the delay will be determined in conformance with the provisions in Section 8-1.09.

10-1.14 TRAFFIC CONTROL SYSTEM FOR LANE CLOSURE

A traffic control system shall consist of closing traffic lanes and ramps in conformance with the details shown on the plans, the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications, the provisions under "Maintaining Traffic" and "Construction Area Signs" of these special provisions, and these special provisions.

The provisions in this section will not relieve the Contractor from the responsibility to provide additional devices or take measures as may be necessary to comply with the provisions in Section 7-1.09, "Public Safety," of the Standard Specifications.

Each vehicle used to place, maintain and remove components of a traffic control system on multilane highways shall be equipped with a Type II flashing arrow sign which shall be in operation when the vehicle is being used for placing, maintaining or removing components. Vehicles equipped with Type II flashing arrow sign not involved in placing, maintaining or removing components when operated within a stationary lane closure shall only display the caution display mode. The sign shall be controllable by the operator of the vehicle while the vehicle is in motion. The flashing arrow sign shown on the plans shall not be used on vehicles which are being used to place, maintain and remove components of a traffic control system and shall be in place before a lane closure requiring its use is completed.

The 150-m section of lane closure, shown along lane lines between the 300-m lane closure tapers on the plans entitled "Traffic Control System for Lane Closures on Freeways and Expressways" and "Traffic Control System for Lane and Complete Closures on Freeways and Expressways" shall not be used.

If components in the traffic control system are displaced or cease to operate or function as specified, from any cause, during the progress of the work, the Contractor shall immediately repair the components to the original condition or replace the components and shall restore the components to the original location.

When lane and ramp closures are made for work periods only, at the end of each work period, components of the traffic control system, except portable delineators placed along open trenches or excavation adjacent to the traveled way, shall be removed from the traveled way and shoulder. If the Contractor so elects, the components may be stored at selected central locations designated by the Engineer within the limits of the highway right of way.

The contract lump sum price paid for traffic control system shall include full compensation for furnishing all labor, materials (including signs), tools, equipment, and incidentals, and for doing all the work involved in placing, removing, storing, maintaining, moving to new locations, replacing, and disposing of the components of the traffic control system shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The adjustment provisions in Section 4-1.03, "Changes," of the Standard Specifications shall not apply to the item of traffic control system. Adjustments in compensation for traffic control system will be made only for increased or decreased traffic control system required by changes ordered by the Engineer and will be made on the basis of the cost of the increased or decreased traffic control necessary. The adjustment will be made on a force account basis as provided in Section 9-1.03, "Force Account Payment," of the Standard Specifications for increased work and estimated on the same basis in the case of decreased work.

Traffic control system required by work which is classed as extra work, as provided in Section 4-1.03D of the Standard Specifications, will be paid for as a part of the extra work.

10-1.15 PORTABLE CHANGEABLE MESSAGE SIGN

Portable changeable message signs shall be furnished, placed, operated, and maintained at those locations provided for in these special provisions or where designated by the Engineer in conformance with the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Attention is directed to Charts 6 through 24 in "Maintaining Traffic" of these special provisions regarding the use and locations of the portable changeable message signs.

Full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing, placing, operating, maintaining, repairing, replacing, transporting from location to location, and removing the portable changeable message signs as specified in these special provisions shall be considered as included in the contract lump sum price paid for traffic control system and no separate payment will be made therefor.

10-1.16 TEMPORARY CRASH CUSHION MODULE

This work shall consist of furnishing, installing, and maintaining sand filled temporary crash cushion modules in groupings or arrays at each location shown on the plans, as specified in these special provisions or where designated by the Engineer. The grouping or array of sand filled modules shall form a complete sand filled temporary crash cushion in conformance with the details shown on the plans and these special provisions.

Attention is directed to "Public Safety", of these special provisions.

Whenever the work or the Contractor's operations establishes a fixed obstacle, the exposed fixed obstacle shall be protected with a sand filled temporary crash cushion. The sand filled temporary crash cushion shall be in place prior to opening the lanes adjacent to the fixed obstacle to public traffic.

Sand filled temporary crash cushions shall be maintained in place at each location, including times when work is not actively in progress. Sand filled temporary crash cushions may be removed during a work period for access to the work provided that the exposed fixed obstacle is 4.6 m or more from a lane carrying public traffic and the temporary crash cushion is reset to protect the obstacle prior to the end of the work period in which the fixed obstacle was exposed. When no longer required, as determined by the Engineer, sand filled temporary crash cushions shall be removed from the site of the work.

At the Contractor's option, the modules for use in sand filled temporary crash cushions shall be either Energite III Inertial Modules, Fitch Inertial Modules or TraFFix Sand Barrels manufactured after March 31, 1997, or equal:

- A. Energite III and Fitch Inertial Modules, manufactured by Energy Absorption Systems, Inc., One East Wacker Drive, Chicago, IL 60601-2076. Telephone 1-312-467-6750, FAX 1-800-770-6755
 - 1. Distributor (North): Traffic Control Service, Inc., 8585 Thys Court, Sacramento, CA 95828. Telephone 1-800-884-8274, FAX 1-916-387-9734
 - 2. Distributor (South): Traffic Control Service, Inc., 1881 Betmor Lane, Anaheim, CA 92805. Telephone 1-800-222-8274, FAX 1-714-937-1070
- B. TraFFix Sand Barrels, manufactured by TraFFix Devices, Inc., 220 Calle Pintesresco, San Clemente, CA 92672. Telephone 1-949 361-5663, FAX 1-949 361-9205
 - 1. Distributor (North): United Rentals, Inc., 1533 Berger Drive, San Jose, CA 95112. Telephone 1-408 287-4303, FAX 1-408 287-1929
 - 2. Distributor (South): Statewide Safety & Sign, Inc., P.O. Box 1440, Pismo Beach, CA 93448. Telephone 1-800-559-7080, FAX 1-805 929-5786

Modules contained in each temporary crash cushion shall be of the same type at each location. The color of the modules shall be the standard yellow color, as furnished by the vendor, with black lids. The modules shall exhibit good workmanship free from structural flaws and objectionable surface defects. The modules need not be new. Good used undamaged modules conforming to color and quality of the types specified herein may be utilized. If used Fitch modules requiring a seal are furnished, the top edge of the seal shall be securely fastened to the wall of the module by a continuous strip of heavy duty tape.

Modules shall be filled with sand in conformance with the manufacturer's directions, and to the sand capacity in kilograms for each module shown on the plans. Sand for filling the modules shall be clean washed concrete sand of commercial quality. At the time of placing in the modules, the sand shall contain not more than 7 percent water as determined by California Test 226.

Modules damaged due to the Contractor's operations shall be repaired immediately by the Contractor at the Contractor's expense. Modules damaged beyond repair, as determined by the Engineer, due to the Contractor's operations shall be removed and replaced by the Contractor at the Contractor's expense.

Temporary crash cushion modules shall be placed on movable pallets or frames conforming to the dimensions shown on the plans. The pallets or frames shall provide a full bearing base beneath the modules. The modules and supporting pallets or frames shall not be moved by sliding or skidding along the pavement or bridge deck.

A Type R or P marker panel shall be attached to the front of the crash cushion as shown on the plans, when the closest point of the crash cushion array is within 3.6 m of the traveled way. The marker panel, when required, shall be firmly fastened to the crash cushion with commercial quality hardware or by other methods determined by the Engineer.

At the completion of the project, temporary crash cushion modules, sand filling, pallets or frames, and marker panels shall become the property of the Contractor and shall be removed from the site of the work. Temporary crash cushion modules shall not be installed in the permanent work.

Temporary crash cushion modules placed in conformance with the provisions in "Public Safety" of these special provisions will not be measured nor paid for.

10-1.17 EXISTING HIGHWAY FACILITIES

The work performed in connection with various existing highway facilities shall conform to the provisions in Section 15, "Existing Highway Facilities," of the Standard Specifications and these special provisions.

Plans of the existing bridges may be requested by fax from the Office of Structure Maintenance and Investigations, 1801 30th Street, Sacramento, CA, Fax (916) 227-8357, and are available at the Office of Structure Maintenance and Investigations, Los Angeles, CA, Telephone (213) 897-6156.

Plans of the existing bridges available to the Contractor are reproductions of the original contract plans with significant changes noted and working drawings and do not necessarily show normal construction tolerances and variances. Where dimensions of new construction required by this contract are dependent on the dimensions of the existing bridges, the Contractor shall verify the controlling field dimensions and shall be responsible for adjusting dimensions of the work to fit existing conditions.

Attention is directed to Section 7-1.06, "Safety and Health Provisions," of the Standard Specifications. Work practices and worker health and safety shall conform to the California Division of Occupational Safety and Health Construction Safety Orders Title 8, of the California Code of Regulations including Section 5158, "Other Confined Space Operations."

REMOVE ASPHALT CONCRETE DIKE

Existing asphalt concrete dike, where shown on the plans to be removed, shall be removed.

Prior to removing the dike, the outside edge of the asphalt concrete to remain in place shall be cut on a neat line to a minimum depth of 50 mm.

The dike shall be removed in such a manner that the surfacing which is to remain in place is not damaged.

The dike shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13 of the Standard Specifications.

Full compensation for remove asphalt concrete dike shall be considered as included in the contract price paid per cubic meter for roadway excavation and no separate payment will be made therefor.

ACCESS OPENING, SOFFIT

Access openings in bridge soffits shall consist of removing portions of existing box girder bridge soffits at the locations and to the dimensions shown on the plans.

A 19-mm deep saw cut shall be made around the perimeter of the soffit areas to be removed.

Bar reinforcing steel shall be removed as shown on the plans. The ends of the remaining bars shall be coated with 2 applications of a zinc-rich primer in the same manner specified for exposed ends of prestressing steel in Section 50-1.05, "Prestressing Steel," of the Standard Specifications.

Within a cell where work is to be performed, existing formwork and miscellaneous concrete that will interfere with the work shall be removed. In addition, when the work is to be done in a cell that adjoins a hinge, all existing forms and sharp projections in the cell between the hinge and 1.5 m past the access opening shall be removed.

All material removed shall become the property of the Contractor and shall be disposed of outside the highway right of way as provided in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

When no longer required, soffit access openings shall be closed as shown on the plans. All materials, including galvanized sheet metal covers, steel hardware, hinges, and corrosion resistant concrete expansion anchorage devices, shall be commercial quality.

Thread locking system shall conform to the provisions in Section 75, "Miscellaneous Metal," of the Standard Specifications.

Unless specified as an option, using deck access openings in lieu of soffit access openings will not be allowed.

Access openings through soffits will be measured and paid for by the unit as access opening, soffit. Openings to be paid for will be determined from actual count of the completed units in place.

The contract unit price paid for access opening, soffit shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the soffit access opening, complete in place, including closing the soffit access opening and removing forms and miscellaneous concrete, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.18 CLEARING AND GRUBBING

Clearing and grubbing shall conform to the provisions in Section 16, "Clearing and Grubbing," of the Standard Specifications and these special provisions.

Existing vegetation outside the areas to be cleared and grubbed shall be protected from injury or damage resulting from the Contractor's operations.

Nothing herein shall be construed as relieving the Contractor of the Contractor's responsibility for final cleanup of the highway as provided in Section 4-1.02, "Final Cleaning Up," of the Standard Specifications.

10-1.19 EARTHWORK

Earthwork shall conform to the provisions in Section 19, "Earthwork," of the Standard Specifications and these special provisions.

Surplus excavated material not designated or determined to contain aurally deposited lead shall become the property of the Contractor and shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Where a portion of the existing surfacing is to be removed, the outline of the area to be removed shall be cut on a neat line with a power-driven saw to a minimum depth of 50 mm before removing the surfacing. Full compensation for cutting the existing surfacing shall be considered as included in the contract price paid per cubic meter for roadway excavation and no additional compensation will be allowed therefor.

10-1.20 MATERIAL CONTAINING AERIALY DEPOSITED LEAD

Earthwork involving materials containing aurally deposited lead shall conform to the provisions in "Earthwork" and this section "Material Containing Aerially Deposited Lead" of these special provisions.

Soil excavated beneath the pavement may be reused or disposed of.

Attention is directed to "Aerially Deposited Lead" of these special provisions.

Type Z-2 material contains aurally deposited lead in average concentrations (1) greater than or equal to 1000 mg/kg Total Lead, or (2) greater than or equal to 5.0 mg/L Soluble Lead, as tested using the California Waste Extraction Test, and the material is surplus, or (3) greater than or equal to 5.0 mg/L Soluble Lead and greater than 350 mg/kg Total Lead, as tested using the California Waste Extraction Test.

Type Z-2 material exists within the area between 0.0-m and 6.7-m, measured horizontally from the edges of existing pavement, and from Engineer's Station 13+00 to Engineer's Station 137+00, or as shown on the plans. These materials shall be excavated to a depth of 0.0-m to 0.9-m below existing grade. These materials are hazardous waste regulated by the State of California and shall be transported to and disposed of at a Class 1 Disposal Site. Materials excavated from these areas shall be transported by a hazardous waste transporter registered with the Department of Toxic Substances Control using the required procedures for the manifest of materials. The vehicles used to transport the hazardous materials shall meet current certifications of compliance of the Department of Toxic Substances Control.

LEAD COMPLIANCE PLAN

The Contractor shall prepare a project specific Lead Compliance Plan to prevent or minimize worker exposure to lead while handling material containing aurally deposited lead. Attention is directed to Title 8, California Code of Regulations, Section 1532.1, "Lead," for specific Cal-OSHA requirements when working with lead.

The Lead Compliance Plan shall contain the elements listed in Title 8, California Code of Regulations, Section 1532.1(e)(2)(B). Before submission to the Engineer, the Lead Compliance Plan shall be approved by an Industrial Hygienist certified in Comprehensive Practice by the American Board of Industrial Hygiene. The Plan shall be submitted to the Engineer for review and acceptance at least 15 days prior to beginning work in areas containing aurally deposited lead.

The Lead Compliance Plan shall include perimeter air monitoring incorporating upwind and downwind locations as shown on the plans or as approved by the Engineer. Monitoring shall be by personal air samplers using National Institute of Safety and Health (NIOSH) Method 7082. Sampling shall achieve a detection limit of $0.05\mu\text{g}/\text{m}^3$ of air per day. Daily monitoring shall take place while the Contractor clears and grubs and performs earthwork operations. A single representative daily sample shall be analyzed for lead. Results shall be analyzed and provided to the Engineer within 24 hours. Average lead concentrations shall not exceed $1.5\mu\text{g}/\text{m}^3$ of air per day. If concentrations exceed this level the Contractor shall stop work and modify the work to prevent release of lead. Monitoring shall be done under the direction of and data reviewed by and signed by a Certified Industrial Hygienist.

The Contractor shall not work in areas containing aurally deposited lead within the project limits, unless authorized in writing by the Engineer, until the Engineer has accepted the Lead Compliance Plan.

Prior to performing work in areas containing aurally deposited lead, personnel who have no prior training or are not current in their training status, including State personnel, shall complete a safety training program provided by the Contractor. The safety training program shall meet the requirements of Title 8, California Code of Regulations, Section 1532.1, "Lead."

Personal protective equipment, training, and washing facilities required by the Contractor's Lead Compliance Plan shall be supplied to State personnel by the Contractor. The number of State personnel will be 2.

The Engineer will notify the Contractor of acceptance or rejection of any submitted or revised Lead Compliance Plan not more than 10 days after submittal of the plan.

The contract lump sum price paid for Lead Compliance Plan shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in preparing the Lead Compliance Plan, including paying the Certified Industrial Hygienist, and for providing personal protective equipment, training and medical surveillance, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

EXCAVATION AND TRANSPORTATION PLAN

Within 15 days after approval of the contract, the Contractor shall submit 3 copies of the Excavation and Transportation Plan to the Engineer. The Engineer will have 7 days to review the Excavation and Transportation Plan. If revisions are required, as determined by the Engineer, the Contractor shall revise and resubmit the Excavation and Transportation Plan within 7 days of receipt of the Engineer's comments. The Engineer will have 7 days to review the revisions. Upon the Engineer's approval of the Excavation and Transportation Plan, 3 additional copies of the Excavation and Transportation Plan incorporating the required changes shall be submitted to the Engineer. Minor changes or clarifications to the initial submittal may be made and attached as amendments to the Excavation and Transportation Plan. In order to allow construction to proceed, the Engineer may conditionally approve the Excavation and Transportation Plan while minor revisions or amendments to the Plan are being completed

DUST CONTROL

Excavation, transportation, placement, and handling of materials containing aurally deposited lead shall result in no visible dust migration. The Contractor shall have a water truck or tank on the job site at all times while clearing and grubbing and performing earthwork operations in work areas containing aurally deposited lead.

Stockpiles of material containing aurally deposited lead shall not be placed where affected by surface run-on or run-off. Stockpiles shall be covered with plastic sheeting 0.33 mm minimum thickness or 0.3 m of non-hazardous material. Stockpiles shall not be placed in environmentally sensitive areas. Stockpiled material shall not enter storm drains, inlets, or waters of the State.

MATERIAL TRANSPORTATION

Prior to traveling on public roads, loose and extraneous material shall be removed from surfaces outside the cargo areas of the transporting vehicles and the cargo shall be covered with tarpaulins, or other cover, as outlined in the approved Excavation and Transportation Plan. The Contractor shall be responsible for costs due to spillage of material containing lead during transport. The Department will not consider the Contractor a generator of these hazardous materials, and the Contractor will not be obligated for further cleanup, removal, or remedial action for such materials handled or disposed of in conformance with the requirements specified in these special provisions and the appropriate State and Federal laws and regulations and county and municipal ordinances and regulations regarding hazardous waste.

DISPOSAL

Surplus materials whose lead content is not known shall be analyzed for aerially deposited lead by the Contractor prior to removing the materials from within the project limits. The Contractor shall submit a sampling and analysis plan and the name of the analytical laboratory to the Engineer at least 15 days prior to beginning sampling or analysis. The Contractor shall use a laboratory certified by the California Department of Health Services. Sampling shall be at a minimum rate of one sample for each 150 m³ of surplus material and tested for lead using EPA Method 6010 or 7000 series.

Sampling, analyses, and reporting of results for surplus materials not previously sampled will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

Sampling, analyzing, transporting, and disposing of materials containing aerially deposited lead excavated outside the pay limits of excavation will be at the Contractor's expense.

MEASUREMENT AND PAYMENT

Quantities of roadway excavation (aerially deposited lead) of the types shown in the Engineer's Estimate, will be measured and paid for in the same manner specified for roadway excavation in Section 19, "Earthwork," of the Standard Specifications.

Full compensation for preparing an approved Excavation and Transportation Plan, transporting material containing aerially deposited lead reused in the work from location to location, and transporting and disposing of material containing aerially deposited lead shall be considered as included in the contract price paid per cubic meter for the items of roadway excavation (aerially deposited lead) involved, and no additional compensation will be allowed therefor.

No payment for stockpiling of material containing aerially deposited lead will be made, unless the stockpiling is ordered by the Engineer.

10-1.21 ASPHALT CONCRETE

Asphalt concrete shall be Type B and shall conform to the provisions in Section 39, "Asphalt Concrete," of the Standard Specifications and these special provisions.

The amount of asphalt binder used in asphalt concrete placed in dikes shall be increased one percent by mass of the aggregate over the amount of asphalt binder determined for use in asphalt concrete placed on the traveled way.

Aggregate for asphalt concrete dikes shall be in conformance with the provisions for 9.5-mm Maximum grading in Section 39-2.02, "Aggregate," of the Standard Specifications.

If the Contractor selects the batch mixing method, asphalt concrete shall be produced by the automatic batch mixing method in conformance with the provisions in Section 39-3.03A(2), "Automatic Proportioning," of the Standard Specifications.

If the finished surface of the asphalt concrete on Route ____ traffic lanes does not meet the specified surface tolerances, the surfacing shall be brought within tolerance by either (1) abrasive grinding (with fog seal coat on the areas which have been ground), (2) removal and replacement or (3) placing an overlay of asphalt concrete. The method will be selected by the Engineer. The corrective work shall be at the Contractor's expense.

If abrasive grinding is used to bring the finished surface to the specified surface tolerances, additional grinding shall be performed, as necessary, to extend the area ground in each lateral direction so that the lateral limits of grinding are at a constant offset from, and parallel to, the nearest lane line or pavement edge, and in each longitudinal direction so that the grinding begins and ends at lines normal to the pavement centerline, within any ground area. Ground areas shall be neat rectangular areas of uniform surface appearance. Abrasive grinding shall conform to the provisions in the first paragraph and the last 4 paragraphs in Section 42-2.02, "Construction," of the Standard Specifications.

10-1.22 STRUCTURE APPROACH SLABS (TYPE R MODIFIED)

Structure approach slabs (Type R Modified) shall consist of removing portions of existing reinforced concrete approach slabs and constructing new portions of reinforced concrete approach slabs at structure approaches as shown on the plans and in conformance with these special provisions.

GENERAL

The thickness shown on the plans for structure approach slabs is the minimum thickness. The thickness will vary depending on the thickness of the pavement and base materials removed.

The Contractor shall establish a grade line for new portions of approach slabs by setting stringlines on each side of the proposed portion of the approach slab. The stringlines shall start approximately 30 m from the structure and extend approximately 15 m onto the structure. The stringlines shall be adjusted as necessary to provide a smooth profile grade for the new portion of the approach slab. The profile grade will be subject to the approval of the Engineer.

The Contractor shall schedule his operations so that the pavement and base materials removed during a work period shall be replaced, in that same work period, with approach slab concrete that shall be cured for at least 6 hours prior to the time the lane is to be opened to public traffic as designated in "Maintaining Traffic" of these special provisions. In the event the existing pavement and base materials are removed and the Contractor is unable, as determined by the Engineer, to construct, finish and cure the new approach slab by the time the lane is to be opened to public traffic, the void created by the removal of concrete and base materials shall be either bridged with temporary deck bridging or filled with a temporary roadway structural section.

TEMPORARY DECK BRIDGING

Temporary deck bridging for bridging deck gaps during deck reconstruction work shall be designed, constructed, monitored, maintained and removed as specified in these special provisions.

All temporary deck bridging components shall be stored at a location such that they can be installed at the void within 30 minutes.

The Contractor shall submit to the Engineer working drawings and design calculations for the temporary deck bridging. The drawings and design calculations shall be signed by an engineer who is registered as a Civil Engineer in the State of California. Three sets of the drawings and one copy of the design calculations shall be furnished.

The temporary deck bridging working drawings shall conform to the requirements in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. Working drawings for any part of the temporary deck bridging shall include, but not be limited to, connection details, modifications to existing bridge members, shop details, erection and removal plans, and equipment lists.

The working drawings shall include descriptions and values of all loads, including construction equipment and vehicular live loads, descriptions of equipment to be used, and complete details and calculations for supporting all loads imposed.

The Contractor shall allow 3 weeks for the review of any temporary deck bridging working drawings after complete drawings, calculations and all support data have been submitted to the Engineer.

Should the Engineer fail to complete the review within the time allowed and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in temporary deck bridging working drawing review, the delay will be considered a right of way delay as specified in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

The temporary deck bridging shall be mechanically connected to the existing structure while subjected to vehicular loads and shall not overstress, induce permanent forces into or produce cracking in the existing structure.

The temporary deck bridging shall be capable of supporting vehicular live loads, dead loads, construction equipment loads and additional loads imposed by the Contractor's operations. The construction equipment loads shall be the actual weight of the construction equipment.

As a minimum, the vehicular loading for the temporary deck bridging shall be the greater of AASHTO HS20-44 loading with 100 percent impact or AASHTO Permit loading with 100 percent impact.

The temporary deck bridging surface shall not vary more than 13 mm horizontally from the existing adjacent deck surfaces.

The temporary deck bridging shall have a uniform surface texture that provides a coefficient of friction of not less than 0.35.

Temporary deck bridging construction shall conform to the requirements for falsework in the first paragraph of Section 51-1.06B, "Falsework Construction," of the Standard Specifications.

Manufactured assemblies shall conform to the provisions in Section 51-1.06A(2), "Design Stresses, Loadings, and Deflections," of the Standard Specifications and these special provisions.

Welding, welder qualification, and inspection of welding shall conform to the requirements of ANSI/AASHTO/AWS D1.5.

Should unanticipated displacements, cracking or other damage occur to the existing structure or to any new components installed at the joint, the construction shall be discontinued until corrective measures satisfactory to the Engineer are performed. Damage to the structure as a result of the Contractor's operations shall be repaired by the Contractor in conformance with the provisions in Section 7-1.11, "Preservation of Property," of the Standard Specifications.

When temporary deck bridging is no longer needed to bridge the void, all temporary deck bridging and connections shall be removed from the existing structure.

If the temporary deck bridging is recessed in the bridge deck, its surface shall not vary more than 6 mm vertically from the existing adjacent deck surfaces.

If a ledge adjacent to the concrete removal limits shown on the plans is used for the support of temporary deck bridging, when temporary bridging is no longer needed, the ledge shall be chipped down at a minimum slope of 1:1 and the concrete to reconstruct the opening shall be placed within a single traffic closure period.

If the temporary deck bridging is not recessed in the bridge deck, the bridging shall be tapered at a 12 to 1 slope.

TEMPORARY ROADWAY STRUCTURAL SECTION

The Contractor shall provide, at the job site, a sufficient quantity, as determined by the Engineer, of a commercial quality cold-laid plant mixture, sand and a suitable cover for the open joint, for construction of a temporary roadway structural section. The temporary structural section shall be maintained, and later removed as a first order of work when the Contractor is able to complete the installation of the new joint seal assembly. The temporary structural section shall consist of a 75-mm depth of cold-laid plant mixture over sand and a temporary cover for the joint.

At the option of the Contractor, he may design, construct and maintain a temporary structural section for the open joints.

If the Contractor elects to design a temporary structural section, he shall submit to the Engineer 3 weeks before starting any work at the existing joint, complete details and working drawings for approval of the temporary structural section, method and equipment he proposes to use in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. Three sets of drawings shall be submitted. These drawings shall show materials used for temporary structural section, including the method of maintaining and removing sections and such details as necessary to supplement the contract plans.

Should the Engineer fail to complete the review within the time allowed and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in temporary structural section working drawing review, the delay will be considered a right of way delay as specified in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

The temporary structural section shall remain in place and be maintained until it is no longer needed to fill the void, at which time it shall be removed from the existing structure.

REMOVING PORTIONS OF EXISTING STRUCTURES

Attention is directed to "Existing Highway Facilities" of these special provisions.

Regardless of the type of equipment used to remove concrete within the sawed outline, the surface of the concrete to be removed shall not be impacted within 0.5-m of the pavement to remain in place. Removing existing pavement and base materials shall be performed without damage to the adjacent structure or pavement that is to remain in place. Damage to the structure or to pavement that is to remain in place shall be repaired to a condition satisfactory to the Engineer. Damaged pavement shall be removed and replaced with new concrete pavement if ordered by the Engineer. Repairing damage to structures or repairing or removing and replacing damaged pavement outside the limits of portion of structure approach slabs as shown on the plans shall be at the Contractor's expense.

Materials removed shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13 of the Standard Specifications.

STRUCTURE APPROACH SLAB

Replacing portion of reinforced concrete approach slabs shall conform to the provisions for approach slabs in Section 51, "Concrete Structures," of the Standard Specifications and these special provisions.

Concrete for use in approach slabs shall contain not less than 400 kg of cement per cubic meter.

Approach slab concrete that requires a minimum curing period of 6 hours shall be constructed using a non-chloride Type C chemical admixture. Mineral admixture will not be required in this concrete.

Portland cement for use in concrete using a non-chloride Type C chemical admixture shall be Type II Modified, Type II Prestress, or Type III. Type II Modified and Type III cement shall conform to the provisions in Section 90-2.01, "Portland Cement," of the Standard Specifications. Type II Prestress cement shall conform to the requirements of Type II Modified cement, except the mortar containing the portland cement to be used and Ottawa sand, when tested in conformance with California Test 527, shall not contract in air more than 0.053-percent.

The non-chloride Type C chemical admixture shall be approved by the Engineer and shall conform to the requirements in ASTM Designation: C 494 and Section 90-4, "Admixtures," of the Standard Specifications.

The concrete with non-chloride Type C chemical admixture shall be prequalified prior to placement in conformance with the provisions for prequalification of concrete specified by compressive strength in Section 90-9.01, "General," of the Standard Specifications and the following:

- A. Immediately after fabrication of the 5 test cylinders, the cylinders shall be stored in a temperature medium of $21 \pm 1.5^{\circ}\text{C}$ until the cylinders are tested.
- B. The 6-hour average strength of the 5 test cylinders shall not be less than 5.85 MPa. No more than 2 test cylinders shall have a strength of less than 5.5 MPa.

Building paper shall be commercial quality No. 30 asphalt felt.

Polyvinyl chloride (PVC) conduit used to encase the abutment tie rod shall be commercial quality.

Bar reinforcement in drilled holes shall be bonded in conformance with the provisions for drilling and bonding dowels in Section 83-2.02D(1), "General," of the Standard Specifications.

The top surface of replaced portion of approach slabs shall be finished in conformance with the provisions in Section 51-1.17, "Finishing Bridge Decks," of the Standard Specifications. The finished top surface shall not vary more than 6 mm from the lower edge of a 3.6-m straightedge placed parallel with the centerline. Edges of slabs shall be edger finished.

The surface of the replaced portion of approach slab will not be profiled and the Profile Index requirements shall not apply.

Replaced portions of approach slabs shall be cured with pigmented curing compound (1) in conformance with the provisions for curing structures in Section 90-7.01B, "Curing Compound Method," of the Standard Specifications. The minimum curing period as specified in this section-"Structure Approach Slabs (Type R)" shall be considered to begin at the start of discharge of the last truck load of concrete to be used in the replaced portion of the slab. Fogging of the surface with water after the curing compound has been applied will not be required. Should the film of curing compound be damaged from any cause before the approach slab is opened to public traffic, the damaged portion shall be repaired immediately with additional compound, at the Contractor's expense. Damage to the curing compound after the approach slab is opened to public traffic shall not be repaired.

If the ambient temperature is below 18°C during the curing period, an insulating layer or blanket shall cover the surface. The insulation layer or blanket shall have an R-value rating given in the table below. At the Contractor's option, a heating tent may be used in lieu of or in combination with the insulating layer or blanket:

Temperature range during curing period	R-value, minimum
13°C to 18°C	1
7°C to 13°C	2
4°C to 7°C	3

Tests to determine the coefficient of friction of the final textured surface will be made only if the Engineer determines by visual inspection that the final texturing may not have produced a surface having the specified coefficient of friction. Tests to determine the coefficient of friction will be made after the approach slab is opened to public traffic, but not later than 5 days after concrete placement. The coefficient of friction will be measured by California Test 342. Portions of completed concrete surfaces that are found to have a coefficient of friction less than 0.35 shall be ground or grooved parallel to the center line in conformance with the provisions for bridge decks in Section 42, "Groove and Grind Pavement," of the Standard Specifications.

MEASUREMENT AND PAYMENT

Structural concrete, approach slab (Type R Modified) will be measured and paid for in conformance with the provisions in Section 51-1.22, "Measurement," and Section 51-1.23, "Payment," of the Standard Specifications and these special provisions.

Full compensation for removing and disposing of portions of existing structures, bar reinforcement, and drilling and bonding of reinforcement shall be considered as included in the contract price paid per cubic meter for structural concrete, approach slab (Type R Modified) and no separate payment will be made therefor.

Full compensation for furnishing, stockpiling, and disposing of material for construction of temporary roadway structural sections; and for constructing, maintaining, removing, and disposing of temporary roadway structural sections; and for designing, furnishing, constructing, monitoring, maintaining and removing temporary bridge decking, including chipping down support ledges, if used, shall be considered as included in the contract price paid per cubic meter for structural concrete, approach slab (Type R modified) and no separate payment will be made therefor.

10-1.23 CORE CONCRETE

Coring concrete shall consist of coring holes through reinforced concrete bridge members as shown on the plans and in conformance with these special provisions.

The holes shall be cored by methods that will not shatter or damage the concrete adjacent to the holes.

Water for core drilling operations shall be from the local domestic water supply or shall not contain more than 1000 parts per million of chlorides as Cl, nor more than 1300 parts per million of sulfates as SO₄, nor shall the water contain any impurities in a sufficient amount that would cause discoloration of the concrete or produce etching of the surface.

Water from core drilling operations shall not be permitted to fall on public traffic, to flow across shoulders or lanes occupied by public traffic, or to flow into gutters or other drainage facilities.

Coring concrete will be measured by the meter as core concrete of the sizes listed in the Engineer's Estimate. The cored concrete will be measured along the centerline of the hole without deduction for expansion joints.

The contract price paid per meter for core concrete of the sizes listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in coring the holes, including control of water from core drilling and repairing any damaged reinforcement, as shown on the plans, as specified in these special provisions, and as directed by the Engineer.

10-1.24 REINFORCEMENT

Reinforcement shall conform to the provisions in Section 52, "Reinforcement," of the Standard Specifications and these special provisions.

The third paragraph of Section 52-1.04, "Inspection," of the Standard Specifications is amended to read:

- A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," shall also be furnished for each shipment of epoxy-coated bar reinforcement or wire reinforcement certifying that the coated reinforcement conforms to the requirements in ASTM Designation: A 775/A 775M or A 884/A 884M, respectively, and the provisions in Section 52-1.02B, "Epoxy-coated Reinforcement." The Certificate of Compliance shall include all of the certifications specified in ASTM Designation: A 775/A 775M or A 884/A 884M respectively, and a statement that the coating material has been prequalified by acceptance testing performed by the Valley Forge Laboratories, Inc., Devon, Pennsylvania.

The third paragraph of Section 52-1.08C, "Mechanical Butt Splices," of the Standard Specifications is amended to read:

- The total slip of the reinforcing bars within the splice sleeve after loading in tension to 200 MPa and relaxing to 20 MPa shall not exceed the values listed in the following table. The slip shall be measured between gage points that are clear of the splice sleeve.

Reinforcing Bar Number	Total Slip (μm)
13	250
16	250
19	250
22	350
25	350
29	350
32	450
36	450
43	600
57	750

The first paragraph of Section 52-1.08C(5), "Sleeve-Lockshear Bolt Mechanical Butt Splices," of the Standard Specifications is amended to read:

- The sleeve-lockshear bolt type of mechanical butt splices shall consist of a seamless steel sleeve, center hole with centering pin, and bolts that are tightened until the bolt heads shear off with the bolt ends left embedded in the reinforcing bars. The seamless steel sleeve shall be either formed into a V configuration or shall have 2 serrated steel strips welded to the inside of the sleeve.

Section 52-1.08F, "Nondestructive Splice Tests," of the Standard Specifications is amended by deleting the seventh paragraph.

10-1.25 STEEL STRUCTURES

Construction of steel structures shall conform to the provisions in Section 55, "Steel Structures," of the Standard Specifications and these special provisions.

Attention is directed to "Welding Quality Control" of these special provisions.

The following substitutions of high-strength steel fasteners shall be made:

METRIC SIZE SHOWN ON THE PLANS	IMPERIAL SIZE TO BE SUBSTITUTED
ASTM Designation: A 325M (Nominal bolt diameter and thread pitch (mm))	ASTM Designation: A 325 (Nominal bolt diameter (inch))
M16 x 2	5/8
M20 x 2.5	3/4
M22 x 2.5	7/8
M24 x 3	1
M27 x 3	1 1/8
M30 x 3.5	1 1/4
M36 x 4	1 1/2

Section 55-3.14, "Bolted Connections," of the Standard Specifications is amended by adding the following after the ninth paragraph:

- If a torque multiplier is used in conjunction with a calibrated wrench as a method for tightening fastener assemblies to the required tension, both the multiplier and the wrench shall be calibrated together as a system. The same length input and output sockets and extensions that will be used in the work shall also be included in the calibration of the system. The manufacturer's torque multiplication ratio shall be adjusted during calibration of the system, such that when this adjusted ratio is multiplied by the actual input calibrated wrench reading, the product is a calculated output torque that is within 2 percent of the true output torque. When this system is used in the work to perform any installation tension testing, rotational capacity testing, fastener tightening, or tension verification, it shall be used, intact as calibrated.

ROTATIONAL CAPACITY TESTING PRIOR TO SHIPMENT TO JOB SITE

Rotational capacity tests shall be performed on all lots of high-strength fastener assemblies prior to shipment of these lots to the project site. Zinc-coated assemblies shall be tested after all fabrication, coating, and lubrication of components has been completed. One hardened washer shall be used under each nut for the tests.

Each combination of bolt production lot, nut lot and washer lot shall be tested as an assembly.

A rotational capacity lot number shall be assigned to each combination of lots tested. Each shipping unit of fastener assemblies shall be plainly marked with the rotational capacity lot number.

Two fastener assemblies from each rotational capacity lot shall be tested.

The following equipment, procedure, and acceptance criteria shall be used to perform rotational capacity tests on, and determine acceptance of long bolts. Fasteners are considered to be long bolts when full nut thread engagement can be achieved when installed in a bolt tension measuring device:

A. Long Bolt Test Equipment:

1. Calibrated bolt tension measuring device with adequate tension capacity for the bolts being tested.
2. Calibrated dial or digital torque wrench. Other suitable tools will be required for performing Steps 7 and 8 of the Long Bolt Test Procedure. A torque multiplier may be required for large diameter bolts.
3. Spacer washers or bushings. When spacer washers or bushings are required, they shall have the same inside diameter and equal or larger outside diameter as the appropriate hardened washers conforming to the requirements in ASTM Designation: F436.
4. Steel beam or member, such as a girder flange or cross frame, to which the bolt tension measuring device will be attached. The device shall be accessible from the ground.

B Long Bolt Test Procedure:

1. Measure the bolt length. The bolt length is defined as the distance from the end of the threaded portion of the shank to the underside of the bolt head.
2. Install the nut on the bolt so that 3 to 5 full threads of the bolt are located between the bearing face of the nut and the underside of the bolt head. Measure and record the thread stickout of the bolt. Thread stickout is determined by measuring the distance from the outer face of the nut to the end of the threaded portion of the shank.
3. Insert the bolt into the bolt tension measuring device and install the required number of washers, and additional spacers as needed, directly beneath the nut to produce the thread stickout measured in Step 2 of this procedure.

4. Tighten the nut using a hand wrench to a snug-tight condition. The snug tension shall not be less than the Table A value but may exceed the Table A value by a maximum of 2 kips.

Table A

High-Strength Fastener Assembly Tension Values to Approximate Snug-Tight Condition	
Bolt Diameter (inches)	Snug Tension (kips)
1/2	1
5/8	2
3/4	3
7/8	4
1	5
1 1/8	6
1 1/4	7
1 3/8	9
1 1/2	10

5. Match-mark the assembly by placing a heavy reference start line on the face plate of the bolt tension measuring device which aligns with 1) a mark placed on one corner of the nut, and 2) a radial line placed across the flat on the end of the bolt, or on the exposed portions of the threads of tension control bolts. Place an additional mark on the outside of the socket that overlays the mark on the nut corner such that this mark will be visible while turning the nut. Make an additional mark on the face plate, either 2/3 of a turn, one turn, or 1 1/3 turn clockwise from the heavy reference start line, depending on the bolt length being tested as shown in Table B.

Table B

Required Nut Rotation for Rotational Capacity Tests ^(a,b)	
Bolt Length (measured in Step 1)	Required Rotation (turn)
4 bolt diameters or less	2/3
Greater than 4 bolt diameters but no more than 8 bolt diameters	1
Greater than 8 bolt diameters, but no more than 12 bolt diameters ^(c)	1 1/3
<p>(a) Nut rotation is relative to bolt, regardless of the element (nut or bolt) being turned. For bolts installed by 1/2 turn and less, the tolerance shall be plus or minus 30 degrees; for bolts installed by 2/3 turn and more, the tolerance shall be plus or minus 45 degrees.</p> <p>(b) Applicable only to connections in which all material within grip of the bolt is steel.</p> <p>(c) When bolt length exceeds 12 diameters, the required rotation shall be determined by actual tests in a suitable tension device simulating the actual conditions.</p>	

6. Turn the nut to achieve the applicable minimum bolt tension value listed in Table C. After reaching this tension, record the moving torque, in foot-pounds, required to turn the nut, and also record the corresponding bolt tension value in pounds. Torque shall be measured with the nut in motion. Calculate the value, T (in ft-lbs), where $T = [(\text{the measured tension in pounds}) \times (\text{the bolt diameter in inches}) / 48 \text{ in/ft}]$.

Table C

Minimum Tension Values for High-Strength Fastener Assemblies	
Bolt Diameter (inches)	Minimum Tension (kips)
1/2	12
5/8	19
3/4	28
7/8	39
1	51
1 1/8	56
1 1/4	71
1 3/8	85
1 1/2	103

7. Turn the nut further to increase bolt tension until the rotation listed in Table B is reached. The rotation is measured from the heavy reference line made on the face plate after the bolt was snug-tight. Record this bolt tension.
8. Loosen and remove the nut and examine the threads on both the nut and bolt.

C. Long Bolt Acceptance Criteria:

1. An assembly shall pass the following requirements to be acceptable: 1) the measured moving torque (Step 6) shall be less than or equal to the calculated value, T (Step 6), 2) the bolt tension measured in Step 7 shall be greater than or equal to the applicable turn test tension value listed in Table D, 3) the nut shall be able to be removed from the bolt without signs of thread stripping or galling after the required rotation in Step 7 has been achieved, 4) the bolt does not shear from torsion or fail during the test and 5) the assembly does not seize before the final rotation in Step 7 is reached. Elongation of the bolt in the threaded region between the bearing face of the nut and the underside of the bolt head is expected and will not be considered a failure. Both fastener assemblies tested from one rotational capacity lot shall pass for the rotational capacity lot to be acceptable.

Table D

Turn Test Tension Values	
Bolt Diameter (inches)	Turn Test Tension (kips)
1/2	14
5/8	22
3/4	32
7/8	45
1	59
1 1/8	64
1 1/4	82
1 3/8	98
1 1/2	118

The following equipment, procedure and acceptance criteria shall be used to perform rotational capacity tests on and determine acceptance of short bolts. Fasteners are considered to be short bolts when full nut thread engagement cannot be achieved when installed in a bolt tension measuring device:

A. Short Bolt Test Equipment:

1. Calibrated dial or digital torque wrench. Other suitable tools will be required for performing Steps 7 and 8 of the Short Bolt Test Procedure. A torque multiplier may be required for large diameter bolts.
2. Spud wrench or equivalent.

3. Spacer washers or bushings. When spacer washers or bushings are required, they shall have the same inside diameter and equal or larger outside diameter as the appropriate hardened washers conforming to the requirements in ASTM Designation: F436.
4. Steel plate or girder with a hole to install bolt. The hole size shall be 1.6 mm greater than the nominal diameter of the bolt to be tested. The grip length, including any plates, washers, and additional spacers as needed, shall provide the proper number of threads within the grip, as required in Step 2 of the Short Bolt Test Procedure.

B. Short Bolt Test Procedure:

1. Measure the bolt length. The bolt length is defined as the distance from the end of the threaded portion of the shank to the underside of the bolt head.
2. Install the nut on the bolt so that 3 to 5 full threads of the bolt are located between the bearing face of the nut and the underside of the bolt head. Measure and record the thread stickout of the bolt. Thread stickout is determined by measuring the distance from the outer face of the nut to the end of the threaded portion of the shank.
3. Install the bolt into a hole on the plate or girder and install the required number of washers, and additional spacers as needed, between the bearing face of the nut and the underside of the bolt head to produce the thread stickout measured in Step 2 of this procedure.
4. Tighten the nut using a hand wrench to a snug-tight condition. The snug condition shall be the full manual effort applied to the end of a 305 mm long wrench. This applied torque shall not exceed 20 percent of the maximum allowable torque in Table E.

Table E

Maximum Allowable Torque for High-Strength Fastener Assemblies	
Bolt Diameter (inches)	Torque (ft-lbs)
1/2	145
5/8	285
3/4	500
7/8	820
1	1220
1 1/8	1500
1 1/4	2130
1 3/8	2800
1 1/2	3700

5. Match-mark the assembly by placing a heavy reference start line on the steel plate or girder which aligns with 1) a mark placed on one corner of the nut, and 2) a radial line placed across the flat on the end of the bolt, or on the exposed portions of the threads of tension control bolts. Place an additional mark on the outside of the socket that overlays the mark on the nut corner such that this mark will be visible while turning the nut. Make 2 additional small marks on the steel plate or girder, one 1/3 of a turn and one 2/3 of a turn clockwise from the heavy reference start line on the steel plate or girder.
6. Using the torque wrench, tighten the nut to the rotation value listed in Table F. The rotation is measured from the heavy reference line described in Step 5 made after the bolt was snug-tight. A second wrench shall be used to prevent rotation of the bolt head during tightening. Measure and record the moving torque after this rotation has been reached. The torque shall be measured with the nut in motion.

Table F

Nut Rotation Required for Turn-of-Nut (a,b) Installation	
Bolt Length (measured in Step 1)	Required Rotation (turn)
4 bolt diameters or less	1/3
(a) Nut rotation is relative to bolt, regardless of the element (nut or bolt) being turned. For bolts installed by 1/2 turn and less, the tolerance shall be plus or minus 30 degrees. (b) Applicable only to connections in which all material within grip of the bolt is steel.	

7. Tighten the nut further to the 2/3-turn mark as indicated in Table G. The rotation is measured from the heavy reference start line made on the plate or girder when the bolt was snug-tight. Verify that the radial line on the bolt end, or on the exposed portions of the threads of tension control bolts, is still in alignment with the start line.

Table G

Required Nut Rotation for Rotational Capacity Test	
Bolt Length (measured in Step 1)	Required Rotation (turn)
4 bolt diameters or less	2/3

8. Loosen and remove the nut and examine the threads on both the nut and bolt.

C. Short Bolt Acceptance Criteria:

1. An assembly shall pass the following requirements to be acceptable: 1) the measured moving torque from Step 6 shall be less than or equal to the maximum allowable torque from Table E, 2) the nut shall be able to be removed from the bolt without signs of thread stripping or galling after the required rotation in Step 7 has been achieved, 3) the bolt does not shear from torsion or fail during the test and 4) the assembly shall not seize before the final rotation in Step 7 is reached. Elongation of the bolt in the threaded region between the bearing face of the nut and the underside of the bolt head will not be considered a failure. Both fastener assemblies tested from one rotational capacity lot shall pass for the rotational capacity lot to be acceptable.

INSTALLATION TENSION TESTING AND ROTATIONAL CAPACITY TESTING AFTER ARRIVAL ON THE JOB SITE

Installation tension tests and rotational capacity tests on high-strength fastener assemblies shall be performed by the Contractor prior to acceptance or installation, and after arrival of the fastener assemblies on the project site. Installation tension tests and rotational capacity tests shall be performed at the job-site, in the presence of the Engineer, on each rotational capacity lot of fastener assemblies.

Installation tension tests shall be performed on 3 representative fastener assemblies in conformance with the provisions in Section 8, "Installation and Tightening," of the RCSC Specification. For short bolts, Section 8(d), "Joint Assembly and Tightening of Slip-Critical and Direct Tension Connections," of the RCSC Specification shall be replaced by the "Pre-Installation Testing Procedures," of the "Structural Bolting Handbook," published by the Steel Structures Technology Center, Incorporated.

The rotational capacity tests shall be performed in conformance with the requirements for rotational capacity tests in "Rotational Capacity Testing Prior to Shipment to Job Site" of these special provisions.

At the Contractor's expense, additional installation tension tests, tests required to determine job inspecting torque and rotational capacity tests shall be performed by the Contractor on each rotational capacity lot, in the presence of the Engineer, if 1) any fastener is not used within 3 months after arrival on the jobsite, 2) fasteners are improperly handled, stored, or subjected to inclement weather prior to final tightening, 3) significant changes are noted in original surface condition of threads, washers or nut lubricant or 4) the Contractor's required inspection is not performed within 48 hours after all fasteners in a joint have been tensioned.

Failure of a job-site installation tension test or a rotational capacity test will be cause for rejection of unused fasteners that are part of the rotational capacity lot.

When direct tension indicators are used, installation verification tests shall be performed in conformance with Appendix Section X1.4 of ASTM Designation: F959, except that bolts shall be initially tensioned to a value 5 percent greater than the minimum required bolt tension.

SURFACE PREPARATION

For all bolted connections the 1) new contact surfaces and 2) inside surfaces of bolt holes shall be cleaned and coated before assembly in conformance with the provisions for cleaning and painting structural steel of these special provisions.

SEALING

The perimeter around all direct tension indicator gaps shall be completely sealed with non-silicone type sealing compound conforming to the provisions in Federal Specification TT-S-230, Type II. The sealant shall be gray in color and have a minimum thickness of 1.3 mm. If painting is required, the sealing compound shall be applied prior to painting.

When zinc-coated tension control bolts are used, the sheared end of each fastener shall be completely sealed with non-silicone type sealing compound conforming to the provisions in Federal Specification TT-S-230, Type II. The sealant shall be gray in color and shall have a minimum thickness of 1.3 mm. The sealant shall be applied to a clean sheared surface on the same day that the splined end is sheared off.

Dimensional details and workmanship for welded joints in tubular and pipe connections shall conform to the provisions in Part A, Common Requirements of Nontubular and Tubular Connections and Part D, Specific Requirements for Tubular Connections, in Section 2 of AWS D1.1.

Backing for welds that are subject to computed stress which are left in place in the completed structure shall be a single length. Backing shall be of the same material as the structural steel being welded. Single lengths of backing shall be obtained by using a continuous strip, or may consist of lengths of backing joined by full penetration butt welds. Butt welds in the backing material shall be subject to the same kind and frequency of testing as specified for the type of joint in the material being joined. Butt welds in backing material shall be ground flush as necessary to obtain proper inspection and for proper fit-up in the weld joint with which the backing is to be used.

10-1.26 SIGN STRUCTURES

Sign structures and foundations for overhead signs shall conform to the provisions in Section 56-1, "Overhead Sign Structures," of the Standard Specifications and these special provisions.

Before commencing fabrication of sign structures, the Contractor shall submit 2 sets of working drawings to the Engineer in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings." The working drawings shall include sign panel dimensions, span lengths, post heights, anchorage layouts, proposed splice locations, a snugging and tensioning pattern for anchor bolts and high strength bolted connections, and details for permanent steel anchor bolt templates. The working drawings shall be supplemented with a written quality control program that includes methods, equipment, and personnel necessary to satisfy the requirements specified herein and in the special provisions.

Working drawings shall be 559 mm x 864 mm or 279 mm x 432 mm in size and each drawing and calculation sheet shall include the State assigned designations for the contract number, sign structure type and reference as shown on the contract plans, District-County-Route-Kilometer Post, and contract number.

The Engineer shall have 20 working days to review the sign structure working drawings after a complete submittal has been received. No fabrication or installation of sign structures shall be performed until the working drawings are approved in writing by the Engineer.

Should the Engineer fail to complete the review within the time allowance and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the sign structure working drawings, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays."

The third paragraph of Section 56-1.01, "Description," of the Standard Specifications shall not apply.

A permanent steel template shall be used to maintain the proper anchor bolt spacing.

One top nut, one leveling nut, and 2 washers shall be provided for the upper threaded portion of each anchor bolt.

Section 56-1.03, "Fabrication," of the Standard Specifications is amended by adding the following 2 paragraphs after the third paragraph:

- Surfaces of base plates which are to come in contact with concrete, grout, or washers and leveling nuts shall be flat to within 3 mm tolerance in 305 mm, and to within 5 mm tolerance overall. Faying surfaces of plates in high-strength bolted connections including flange surfaces of field splices, chord joints, and frame junctures, and contact surfaces of plates used for breakaway slip base assemblies shall be flat to within 2 mm tolerance in 305 mm, and within 3 mm tolerance overall.

- Thermally cut holes made in tubular members of sign supports, other than holes in base and flange plates, shall initially be made a minimum of 2 mm undersized, and then be mechanically enlarged by reaming or grinding to the final required size and shape. All edges shall have a surface roughness of not greater than 6.35 μm . Round holes may be drilled to the exact final diameter. No holes shall be made in members unless the holes are shown on the plans or are approved in writing by the Engineer.

The sixth through the thirteenth paragraphs in Section 56-1.03, "Fabrication," of the Standard Specifications are amended to read:

- High-strength bolted connections, where shown on the plans, shall conform to the provisions in Section 55-3.14, "Bolted Connections," except that only fastener assemblies consisting of a high-strength bolt, nut, hardened washer, and direct tension indicator shall be used.
- High-strength fastener assemblies, and any other bolts, nuts, and washers attached to sign structures shall be zinc-coated by the mechanical deposition process.
- An alternating snugging and tensioning pattern for anchor bolts and high-strength bolted splices shall be used. Once tensioned, high-strength fastener components and direct tension indicators shall not be reused.
- For bolt diameters less than 10 mm, the diameter of the bolt hole shall be not more than 0.80-mm larger than the nominal bolt diameter. For bolt diameters greater than or equal to 10 mm, the diameter of the bolt hole shall be not more than 1.6 mm larger than the nominal bolt diameter.
- Sign structures shall be fabricated into the largest practical sections prior to galvanizing.
- Ribbed sheet metal panels for box beam closed truss sign structures shall be fastened to the truss members by cap screws or bolts as shown on the plans, or by 4.76 mm stainless steel blind rivets conforming to Industrial Fasteners Institute, Standard IFI-114, Grade 51. The outside diameter of the large flange rivet head shall be not less than 15.88 mm in diameter. Web splices in ribbed sheet metal panels may be made with similar type blind rivets of a size suitable for the thickness of material being connected.
- Spalling or chipping of concrete structures shall be repaired by the Contractor at the Contractor's expense.
- Overhead sign supports shall have an aluminum identification plate permanently attached near the base, adjacent to the traffic side on one of the vertical posts, using either stainless steel rivets or stainless steel screws. As a minimum, the information on the plate shall include the name of the manufacturer, the date of manufacture and the contract number.

Steel members used for overhead sign structures shall receive nondestructive testing (NDT) in conformance with AWS D1.1 and the following:

A.

Weld Location	Weld Type	Minimum Required NDT
Welds for butt joint welds in tubular sections, nontubular sections, and posts	CJP groove weld with backing ring	100% UT or RT
Longitudinal seam welds*	PJP groove weld	25% MT
	CJP groove weld	100% UT or RT
Welds for base plate, flange plate, or end cap to post or mast arm	CJP groove weld	25% UT or RT
	Fillet weld	25% MT
* Longitudinal seam welds shall have 60% minimum penetration, except that within 150 mm of any circumferential weld, longitudinal seam welds shall be CJP groove welds.		

- B. A written procedure approved by the engineer shall be used when performing UT on material less than 8 mm thick. Contoured shoes shall be used when performing UT on round tubular sections under 1270 mm in diameter.
- C. When less than 100 percent of a weld is specified for NDT, and if defects are found during this inspection, additional NDT shall be performed. This additional NDT shall be performed on 25 percent of the total weld for all similar welds, as determined by the Engineer, produced for sign structures in the project. If any portion of the additional weld inspected is found defective, 100 percent of all similar welds produced for sign structures in the project, as determined by the Engineer, shall be tested.

Circumferential welds and base plate to post welds may be repaired only one time without written permission from the Engineer.

Full compensation for furnishing anchor bolt templates and for testing of welds shall be considered as included in the contract price paid per kilogram for furnish sign structure and no additional compensation will be allowed therefor.

10-1.27 TIMBER RETAINING WALLS

Timber crib walls shall be constructed as shown on the plans and in conformance with the provisions in Section 57, "Timber Structures," of the Standard Specifications, and these special provisions.

Attention is directed to the section, "Order of Work," in these special provisions regarding crib wall timber.

Timbers shall be full sawn, No. 1 grade Douglas fir-Larch.

Timber shall be pressure treated after fabrication with creosote, creosote-coal tar solution, creosote-petroleum solution (50-50) or pentachlorophenol (Type A or C). Only one type of preservative shall be used for treating the timber for each separate installation. The application of preservative treatment shall be that recommended for below ground use.

The members shall be handled in such a manner that prevents damage. Members that are damaged during handling and placing shall be removed and replaced with new members by the Contractor at the Contractor's expense.

Timber retaining walls shall be placed to the lines and grades established by the Engineer. Excavation as shown on the plans shall conform to the provisions in Section 19, "Earthwork," of the Standard Specifications, and in "Earthwork" of these special provisions. The excavation shall be approved in writing by the Engineer before any timber members are placed.

Timber retaining walls will be measured by the meter from the beginning to the end of the wall.

The contract price paid per meter for timber retaining wall shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing timber retaining walls, including excavation and backfill, and cement slurry, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.28 METAL BEAM GUARD RAILING

Metal beam guard railing shall be constructed in conformance with the provisions in Section 83-1, "Railings," of the Standard Specifications and these special provisions.

Attention is directed to "Order of Work" of these special provisions.

Line posts and blocks shall be wood.

Delete the ninth and eleventh paragraphs in Section 83-1.02B, "Metal Beam Guard Railing," of the Standard Specifications.

The grades and species of wood posts and blocks shall be No. 1 timbers (also known as No. 1 structural) Douglas fir or No. 1 timbers Southern yellow pine. Wood posts and blocks shall be graded in conformance with the provisions in Section 57-2, "Structural Timber," of the Standard Specifications, except allowances for shrinkage after mill cutting shall in no case exceed 5 percent of the American Lumber Standards minimum sizes, at the time of installation.

Wood posts and blocks shall be pressure treated after fabrication in conformance with the provisions in Section 58, "Preservative Treatment of Lumber, Timber and Piling," of the Standard Specifications with creosote, creosote coal tar solution, creosote petroleum solution (50-50), pentachlorophenol in hydrocarbon solvent, copper naphthenate, ammoniacal copper arsenate, or ammoniacal copper zinc arsenate. In addition to the preservatives listed above, Southern yellow pine may also be pressure treated with chromated copper arsenate. When other than one of the creosote processes is used, blocks shall have a minimum retention of 6.4 Kg/m^3 , and need not be incised.

SECTION 10-2. IRRIGATION SYSTEMS

10-2.01 GENERAL

The work performed in connection with highway planting and irrigation systems shall conform to the provisions in Section 20, "Erosion Control and Highway Planting," of the Standard Specifications and these special provisions.

The Contractor shall notify the Engineer not less than 72 hours prior to requiring initial access to the existing irrigation controllers. When the Engineer determines that access to the controllers is required at other times, arrangements will be made to provide this access.

COST BREAK-DOWN

The Contractor shall furnish the Engineer a cost break-down for the contract lump sum item of irrigation system.

The cost break-down shall be completed and furnished in the format shown in the sample of the cost break-down included in this section. Unit descriptions of work shown in the samples are the minimum to be submitted. Additional unit descriptions of work may be designated by the Contractor. If the Contractor elects to designate additional unit descriptions of work, the quantity, value and amount for those units shall be completed in the same manner as for the unit descriptions shown in the samples. The units and quantities given in the sample are to show the manner of preparing the cost break-down to be furnished by the Contractor.

The Contractor shall determine the quantities required to complete the work shown on the plans. The quantities and their values shall be included in the cost break-down submitted to the Engineer for approval. The Contractor shall be responsible for the accuracy of the quantities and values used in the cost break-down submitted for approval.

No adjustment in compensation will be made in the contract lump sum price paid for irrigation system due to differences between the quantities shown in the cost break-down furnished by the Contractor and the quantities required to complete the work as shown on the plans and as specified in these special provisions.

The sum of the amounts for the units of work listed in the cost break-down for irrigation system work shall be equal to the contract lump sum price bid for the work. Cost break-downs shall be submitted to the Engineer for approval within 15 working days after the contract has been approved. Cost break-downs shall be approved, in writing, by the Engineer before partial payment for the item of irrigation system will be made.

Approved cost break-downs will be used to determine partial payments during the progress of the work and as the basis for calculating the adjustment in compensation for the item of irrigation system due to changes ordered by the Engineer. When an ordered change increases or decreases the quantities of an approved cost break-down, the adjustment in compensation will be determined in the same manner specified for increases and decreases in the quantity of a contract item of work in conformance with the provisions in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications.

IRRIGATION SYSTEM COST BREAK-DOWN

Contract No. 07-129944

UNIT DESCRIPTION	UNIT	APPROXIMATE QUANTITY	VALUE	AMOUNT
CHECK, TEST, RELOCATE AND REMOVE EXISTING IRRIGATION FACILITIES	LS	LUMP SUM		
CONTROL AND NEUTRAL CONDUCTORS	LS	LUMP SUM		
40 mm GALVANIZED STEEL PIPE (SUPPLY LINE)	M	55		
20 mm PLASTIC PIPE (PR 200) (SUPPLY LINE)	M	5		
25 mm PLASTIC PIPE (PR 200) (SUPPLY LINE)	M	5		
32 mm PLASTIC PIPE (PR 200) (SUPPLY LINE)	M	10		
40 mm PLASTIC PIPE (PR 200) (SUPPLY LINE)	M	30		
50 mm PLASTIC PIPE (PR 200) (SUPPLY LINE)	M	85		
100 mm PLASTIC PIPE (PR 200) (SUPPLY LINE)	M	100		
FINAL IRRIGATION SYSTEM CHECK	LS	LUMP SUM		

TOTAL _____

10-2.02 EXISTING HIGHWAY PLANTING

In addition to the provisions in Section 20 of the Standard Specifications, work performed in connection with existing highway planting shall be in conformance with the provisions in Section 15, "Existing Highway Facilities," of the Standard Specifications and these special provisions.

Replacement planting shall conform to the requirements specified under "Preservation of Property" of these special provisions.

MAINTAIN EXISTING PLANTS

Existing plants shall be maintained as directed by the Engineer. Maintaining existing plants will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

REMOVE EXISTING PLANTS FOR TRENCHING

Removing existing plants for trenching shall conform to the provisions in Section 20-5.026, "Remove Existing Plants for Trenching," of the Standard Specifications and these special provisions.

Removing existing plants for trenching work shall consist of removing and replacing ground cover, pruning trees and shrubs within trench locations, and disposing of removed ground cover and prunings.

Replacement of removed ground cover within the maximum 1.8-m width, as specified in Section 20-5.026, "Remove Existing Plants for Trenching," of the Standard Specifications, will be required, except for trenches within 1.8-m of fences, curbs, dikes or shoulders.

Trees and shrubs adjacent to dikes, walks, fences, guard railing, and pavement edges may be pruned back 3 m from these facilities to facilitate trenching work. When trenching is to be performed adjacent to other trees and shrubs that cannot be avoided, the trees and shrubs may be pruned upon receipt of prior written approval of the Engineer.

Pruning shall include removal of deadwood, suckers, and broken or bruised branches 25 mm or larger in diameter. Pruning shall conform to the provisions in Section 20-4.055, "Pruning," of the Standard Specifications.

Removed ground cover and pruned materials shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Shrubs adjacent to dikes, fences, guard railing, and the edge of pavement within the 3-m pruned area designated above, that in the opinion of the Engineer should be removed after pruning, shall be removed and disposed of. Removing and disposing of the shrubs not otherwise provided for will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

PRUNE EXISTING PLANTS

Existing plants, as determined by the Engineer, shall be pruned. Pruning of the existing plants, except as otherwise provided in these special provisions, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

10-2.03 EXISTING HIGHWAY IRRIGATION FACILITIES

The work performed in connection with the various existing highway irrigation system facilities shall conform to the provisions in Section 15, "Existing Highway Facilities," of the Standard Specifications and these special provisions.

Water shall be maintained in conformance with the provisions in Section 20-5.025, "Maintain Existing Water Supply," of the Standard Specifications.

CHECK AND TEST EXISTING IRRIGATION FACILITIES

Existing irrigation facilities at each location of work, shall be checked in the presence of the Engineer for missing or damaged components and proper operation prior to performing trenching operations. Existing irrigation facilities outside of work areas that are affected by the construction work shall also be checked for proper operation.

A written list of existing irrigation system deficiencies shall be submitted to the Engineer within 2 working days after checking the existing facilities.

Deficiencies found during checking of the existing facilities shall be corrected as directed by the Engineer. Corrective work ordered by the Engineer will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Repairs to the existing irrigation facilities ordered by the Engineer after checking and testing the facilities, and further repairs or modifications required thereafter as ordered by the Engineer, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

After all work is completed at each location, the irrigation facilities shall be checked in the presence of the Engineer, and any damage to the existing and modified irrigation facilities caused by the Contractor's operations shall be repaired within 5 working days at the expense of the Contractor.

REMOVE EXISTING IRRIGATION FACILITIES

Existing irrigation facilities where shown on the plans to be removed, shall be removed. Facilities that are more than 150 mm below finished grade may be abandoned in place.

Immediately after disconnecting an existing irrigation facility to be removed or abandoned from an existing facility to remain, the remaining facility shall be capped or plugged, or shall be connected to a new or existing irrigation facility.

Facilities to be removed shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

RELOCATE EXISTING IRRIGATION FACILITIES

Relocate existing irrigation facilities shall consist of relocating existing electric remote control valves, sprinklers, and other facilities shown on the plans or specified in these special provisions.

Relocate existing valves shall consist of relocating existing valves, valve boxes and valve box covers. Relocated valve boxes shall be installed with new woven wire cloth and crushed rock bedding as shown on the plans.

Relocate existing sprinklers shall consist of relocating existing sprinklers, riser supports, as shown on the plans.

Relocate pull boxes shall consist of relocating existing pull boxes and pull box covers. Relocated pull boxes shall be installed on new woven wire cloth and crushed rock bedding as shown on the plans for valve box installations.

Existing irrigation facilities, shown on the plans to be relocated, that are, in the opinion of the Engineer, unsuitable for the purpose intended, shall be replaced in conformance with the provisions in Section 15-2.05, "Reconstruction," of the Standard Specifications.

After irrigation facilities have been relocated, the Contractor shall demonstrate that the relocated facilities function properly in the presence of the Engineer.

10-2.04 (BLANK)

10-2.05 IRRIGATION SYSTEMS

Irrigation systems shall be furnished and installed in conformance with the provisions in Section 20-5, "Irrigation Systems," of the Standard Specifications, except materials containing asbestos fibers shall not be used.

Attention is directed to the provisions in "Obstructions" of these special provisions, regarding work over or adjacent to existing underground facilities. Excavation for proposed irrigation facilities shall not be started until the existing underground facilities have been located.

Pipe supply lines shall be pressure tested in conformance with the provisions in Section 20-5.03H, "Pressure Testing," of the Standard Specifications, except the pipe (supply line) on the discharge side of the control valve shall be tested by Method B as specified in Section 20-5.03H(2), "Method B," of the Standard Specifications.

Only pipeline trenches and excavation pits for supply lines being supplied from one water service point shall be open at one time. After pressure testing is complete, trenches and pits excavated for pipe supply lines, being supplied from one water service point, shall be backfilled prior to commencing excavations for pipe supply lines being supplied from another water service point.

VALVE BOXES

Valve boxes shall conform to the provisions in Section 20-2.24, "Valve Boxes," of the Standard Specifications, except as otherwise provided herein.

Valve boxes shall be precast portland cement concrete.

Covers for concrete valve boxes shall be cast iron or steel. Cast iron and steel covers shall be hinged with brass hinge pins for valve boxes containing valves smaller than 50 mm.

Valve boxes shall be identified on the top surface of the covers by labels containing the appropriate abbreviation for the irrigation facility contained in the valve box as shown on the plans. Valve boxes that contain remote control valves shall be identified by the appropriate letters and numbers (controller and station numbers). Labels for valve boxes shall conform to the provisions in Section 20-5.03F, "Valves and Valve Boxes," of the Standard Specifications.

Label material shall be polyurethane with contrasting colors for the base, letters, and numbers.

ELECTRIC AUTOMATIC IRRIGATION COMPONENTS

Pull Boxes

Pull box installations shall conform to the provisions in Section 20-5.027I, "Conductors, Electrical Conduits and Pull Boxes," of the Standard Specifications.

Conductors

Low voltage, as used in this section "Conductors," shall mean 36 V or less.

Low voltage control and neutral conductors in pull boxes and valve boxes, at irrigation controller terminals, and at splices shall be marked as follows:

- A. Conductor terminations and splices shall be marked with adhesive backed paper markers or adhesive cloth wrap-around markers, with clear, heat-shrinkable sleeves sealed over the markers.
- B. Non-spliced conductors in pull boxes and valve boxes shall be marked with clip-on, "C" shaped, white extruded polyvinyl chloride sleeves. Marker sleeves shall have black, indented legends of uniform depth with transparent overlays over the legends and "chevron" cuts for alignment of 2 or more sleeves.

Markers for the control conductors shall be identified with the appropriate number or letter designations of irrigation controllers and station numbers. Markers for neutral conductors shall be identified with the appropriate number or letter designations of the irrigation controllers.

New control and neutral conductors that are to replace existing control and neutral conductors shall be the same size and color as the existing control and neutral conductors being connected to.

The color of low voltage neutral and control conductor insulation, except for the striped portions, shall be homogeneous throughout the entire thickness of the insulation.

Insulation for conductors may be UL listed polyethylene conforming to UL44 test standards with a minimum insulation thickness of 1.05 mm for wire sizes 10AWG and smaller.

At the option of the Contractor, other types of splice sealing materials and methods may be used provided other materials and methods have been approved in writing by the Engineer prior to installation of the connectors.

PIPE

Steel Pipe

Galvanized steel pipe supply line shall be installed not less than 400 mm below finished grade, measured to the top of the pipe.

Galvanized steel pipe supply line shall be installed at the bottom of trenches and the trenches shall be backfilled with sand to a depth of 50 mm over the top of the pipe. The remainder of the trench, shall be backfilled with material excavated from the trenches, except that rocks, broken concrete, and other lumps larger than 50 mm in greatest dimension shall not be used.

Plastic Pipe

Plastic pipe supply lines shall be polyvinyl chloride (PVC) 1120 or 1220 pressure rated pipe with the minimum pressure rating (PR) shown on the plans.

All plastic pipe supply lines shall have solvent cemented type joints. Primers shall be used on the solvent cemented type joints.

Plastic pipe supply lines (main) shall have a minimum cover of 0.45 m.

Fittings for plastic pipe supply lines with a pressure rating (PR) of 315 shall be Schedule 80.

FINAL IRRIGATION SYSTEM CHECK

A final check of existing and new irrigation facilities shall be performed in the presence of the Engineer not more than 20 working days prior to acceptance of the contract.

The length of watering cycles using potable water measured by water meters for the final check of irrigation facilities will be determined by the Engineer.

Remote control valves connected to existing irrigation controllers shall be checked for automatic performance when the controllers are in automatic mode.

Unsatisfactory performance of irrigation facilities installed or modified by the Contractor shall be repaired and rechecked at the Contractor's expense until satisfactory performance is obtained, as determined by the Engineer.

Repair or replacement of existing irrigation facilities due to unsatisfactory performance shall conform to the provisions in "Existing Highway Irrigation Facilities" of these special provisions.

Nothing in this section "Final Irrigation System Check" shall relieve the Contractor of full responsibility for making good or repairing defective work or materials found before the formal written acceptance of the entire contract by the Director.

Full compensation for checking the irrigation systems prior to the acceptance of the contract shall be considered as included in the contract lump sum price paid for irrigation system and no additional compensation will be allowed therefor.

SECTION 10-3. SIGNALS, LIGHTING AND ELECTRICAL SYSTEMS

10-3.01 DESCRIPTION

Electrical systems for the closed circuit television (CCTV), fiber optic communication system, changeable message sign (CMS) system, highway advisory radio (HAR), HAR flashing beacon and sign, traffic monitoring stations (TMS), communication conduit, , pull box, system test and documentation, and soffit access opening shall conform to the provisions in Section 86, "Signals, Lighting and Electrical Systems," of the Standard Specifications and these special provisions.

Locations of traffic monitoring station and ramp metering system installations are shown on the communication routing plans.

Traffic monitoring station 2703 near Chevy Chase Drive
Traffic monitoring station 1463 near Mountain Street
Traffic monitoring station 2607 near Sherer Lane
Traffic monitoring station 2473 near Fern Lane
Ramp metering system 1467 near Colorado Street
Ramp metering system 1472-near Verdugo Boulevard
Traffic monitoring station 1456 near Newell Street
Traffic monitoring station 2458 near Ripple Street
Traffic monitoring station 1457 near Fletcher Drive
Traffic monitoring station 1458 North San Fernando Road
Traffic monitoring station 2479 near Estara Avenue
Traffic monitoring station 1459 South of Verdugo Road
Traffic monitoring station 1460 at Delevan Drive
Traffic monitoring station 2606 North of Round Top Drive
Traffic monitoring station 2460 near Broadway Street
Traffic monitoring station 1461 at Holy Drive
Ramp metering system 1815 near Route 2 / Route 5 Separation

Communication conduit is included in the following structures:

Ripple Street Undercrossing (Bridge No. 53-0283F)
Los Angeles River Undercrossing (Bridge No. 53-0255)
Taylor Yard Overhead (Bridge No. 53-1039)
San Fernando Road Undercrossing (Bridge No. 53-0743)
Delay Drive Overhead (Bridge No. 53-1040)
Verdugo Road (Bridge No. 53-1929)
York Boulevard Undercrossing (Bridge No. 53-1993)
Round Top Drive Undercrossing (Bridge No. 53-1975)
Colorado Boulevard Undercrossing (Bridge No. 53-1915)
Broadway Undercrossing (Bridge No. 53-1916)
Glenoaks Boulevard Undercrossing (Bridge No. 53-1967)
Chevy Chase Drive Undercrossing (Bridge No. 53-1968)
Sherer Lane Undercrossing (Bridge No. 53-1894)
Fern Lane Undercrossing (Bridge No. 53-2366)
Stancrest Drive Undercrossing (Bridge No. 53-2242)
Verdugo Boulevard Undercrossing (Connector) (Bridge No. 53-2220G)

Closed circuit television system work is to be performed at the following locations:

Location GL011 - KP 25.2 - Southbound Route 2 at Fletcher Drive- New ID 590.
Location GL031 - KP 27.2 - Northbound Route 2 South of Verdugo Road -New ID 591
Location GL051 - KP 29.2 - Northbound Route 2 South of Colorado Street Off-Ramp -
New ID 592
Location GL068 - KP 30.9 - Northbound Route 2 South of Chevy Chase Drive - New ID 593
Location GL131 - KP 37.2 - Route 210 / Route 2 separation - New ID 594
Highway Advisory Radio (HAR) system work is to be performed at the following location:
Location GL011- North of Fletcher Drive

HAR flashing beacon and sign system work is to be performed at the following locations:

Location 1- South of Ripple Street

Location 2- South of Colorado Boulevard

Location 3 – Near Holy Drive

Changeable message sign system work is to be performed at the following locations:

Changeable message sign No. 122 - Southbound Route 2 near Avenue 34

Changeable message sign No. 121 - Northbound Route 2 near Avenue 36

The Contractor shall confirm equipment placement with the Engineer before installing any equipment.

10-3.02 ABBREVIATIONS AND GLOSSARY

The following Abbreviations and Glossary apply to Section 10-3 through Section 10-6 of these special provisions.

Abbreviations:

&	And
#	number
ADM:	Add Drop Multiplexer.
AFC:	Automated Frequency Control.
AGC:	Automatic gain control.
AIS:	Alarm Indication Signal.
AISI:	American Iron and Steel Institute.
AMI:	Alternate Mark Inversion (a data transmission protocol.)
APD:	Avalanche Photo diode.
APL:	Average picture level.
APS:	Automatic Protection Switch.
AVC	Automatic vehicle classification system
AWG	American wire gauge
AWM:	Appliance Wiring Material.
B8ZS:	Bipolar 8 Zero Suppression(data transmission protocol)
BER:	Bit error rate.
BERTS:	Bit Error Rate Test Set.
BITS:	Building Integrated Timing Supply.
BNC:	Bayonet Navy Connector.
bps:	Bits per second.
BPV:	Bipolar Violation.
CCD:	Charge-Coupled Device.
CCK:	Camera Control Key pad.
CCR:	Camera Control Receiver
CCT:	Camera Control Transmitter.
CCTV:	Closed Circuit Television.
cfm:	Cubic feet per minute.
CFR:	Code of Federal Regulations.
CIDH:	Cast In Drilled Hole.
CMIP:	Configuration Management Information Protocol.
CMISE:	Common Management Information Service Entity.
CMP:	Configuration Management Plan.
CMS:	Changeable Message Sign.
CODEC:	Coder - Decoder.
COMM	Communication
CPU:	Central Processing Unit.
CRT:	Cathode Ray Tube.
CTRL	Controller
DACCS	Digital access and cross connection system
D4:	4th version of the D-signal format for time division multiplexers.

dB:	Decibel.
dBm:	Decibel referred to milliwatt.
dBm:	Decibel above reference noise.
DCD:	Data carrier detect
DCE:	Data communication equipment.
DTE:	Data Circuit Terminating Equipment.
DEMARC	Demarcation
DEMUX	Demultiplexer
DCS:	Digital Cross-Connect System.
DS-1:	Digital Signal Level 1. Digital Transmission Rate - 1.544 megabits per second.
DS-3:	Digital Signal Level 3. Digital Transmission Rate - 44.876 megabits per second.
DWP:	LA Dept. of Water and Power
EIA:	Electronics Industries Association.
EMT:	Electrical Metallic Tubing.
ESF:	Extended Superframe or Extended Superframe Format (4).
E/O	east of
FCC	Federal Communications Commission
F/O or FO:	Fiber optic.
FDF	Fiber Distribution Frame
FDU:	Fiber Distribution Unit.
FRP:	Fiberglass Reinforced Plastic.
FXS:	Foreign Exchange Subscriber.
GFCI:	Ground Fault Circuit Interrupter.
GUI	Graphical User Interface.
HAR:	Highway Advisory Radio.
HVAC:	Heating Ventilation and Air Conditioning.
Hz:	Hertz.
IRE:	IRE is a SMPTE Standard video reference level.
ITUR	International Telecommunications Union Radio
JKFD:	Jackfield
KP	Kilometer Post
LA	Los Angeles
M13:	Multiplexer, 28 DS-1 circuits to 1 DS-3 circuit.
MHz:	Megahertz.
MMFO:	Multimode fiber optics
MUX:	Multiplexer
NEMA:	National Electrical Manufacturers Association.
NHD	North Hollywood
nm:	nanometer.
NMS:	Network Management System.
NRZ:	Non-return to Zero.
NTSC:	National Television Standards Committee.
OC:	Optical Channel.
OD:	Outside Diameter.
OEM	Original Equipment Manufacturer.
OSHA:	Occupational Safety and Health Administration.
OW	Order wire (Multiple voice circuit)
P	Pair
P22	Pair 22 American Wire Gauge
PAC BELL	Pacific Bell telephone Company
p-p:	Peak to Peak.
PC:	Personal Computer.
PCMS:	Pasadena City Municipal Services
PDA	Power distribution assembly
PIN:	P-type, intrinsic, N-type.
PR	Pair
PRBS:	Pseudo-Random Bit Sequence pattern.
QRSS:	Quasi-Random Signal Source.

REA:	United States Rural Electrification Administration.
RETMA:	Radio-Electronics-Television Manufacturers Association (Former name of EIA.)
RF:	Radio Frequency.
RG:	Regulatory Guide.
RMS:	Ramp Metering Station.
RMS:	Root-mean-square.
RTS:	Request to send.
RTMC:	Regional Traffic Management Center.
SF:	Superframe Format (D4).
SM:	Singlemode.
SMFO:	Singlemode Fiber Optic.
SONET:	Synchronous Optical Network.
SSOVP:	Solid State Over-voltage Protector.
SSPC:	Steel Structures Painting Council.
ST:	Type of Connector.
TDM:	Time Division Multiplexer.
THHN:	Heat Resistant thermoplastic with Nylon Jacket Conductor.
THWN:	Moisture and Heat Resistant Thermoplastic with Nylon Jacket Conductor.
TIA:	Telecommunications Industries Association.
TL-1:	Transaction Language 1.
TLP:	Transmission Level Point.
TMC:	Traffic Management Center.
TSG:	Test Signal Generator.
TSI:	Time Slot Interchange.
UNC:	Unified National Coarse.
UNIX:	Specific operating system found in real-time applications.
UV:	Ultraviolet.
V:	Volt.
VAC:	V, Alternating Current.
VSAT:	Very Small Aperture Terminal
VID:	Video Identification and Date/Time Display.
VSK:	Video switch keypad.
VSM:	Video switch matrix.
VT-1.5:	Virtual Tributary-Level 1.5 (1.728 Mb/s.).
VT:	Virtual Tributary.
W:	Watt.
WFM:	Waveform Monitor.
WTO:	Wire Transit Only.
X.11, X.25:	specific protocol standards generated by the International Telecommunications Union (formerly CCITT.)
XHHW:	Moisture and Heat Resistant Cross Linked Synthetic Polymer Conductor.

Glossary:

Breakout.--The cable "breakout" is produced by (1) removing the jacket just beyond the last tie-wrap point, (2) exposing 0.9 m to 1.8 m of the cable buffers, aramid strength yarn and central fiberglass strength member, and (3) cutting the aramid yarn, central strength member and the buffer tubes to expose the individual glass fibers for splicing or connection to the appropriate device.

Cable Storage Cabinet.--A cabinet for holding excess cable slack for protection. The cable storage cabinet allows the user flexibility in equipment location and the ability to pull cable back for re-splicing.

Channel.--(1) An information path between a discrete input and a discrete output. 2) One single input to a multiplexer or output from a demultiplexer.

Closed Circuit Television Assembly.--Camera, lens, environmental enclosure, and necessary connectors and cables.

Connector.--A mechanical device used to provide a means for attaching to and decoupling from a transmitter, receiver, or another fiber (such as on a patch panel).

Connectorized.--A term that describes a fiber to which a connector has been affixed.

Connector Module Housing (CMH).--A patch panel used in the FDF to terminate singlemode fibers with most common connector types. It may include a jumper storage shelf and a hinged door.

Couplers.--Couplers are devices which mate two fiber optic connectors to facilitate the transition of optical light signals from one connector into another. Couplers may also be referred to as: adapters, feed-throughs, and barrels. They are normally located within FDF's mounted in panels. They may also be used unmounted, to join two simplex fiber runs.

Fiber Distribution Frame (FDF).--A rack mounted system that is usually installed in the TMC or RTMC, that consists of a standard equipment rack, fiber routing guides, horizontal jumper troughs, fiber distribution units (FDU), connector module housings (CMH), and splice module housings (SMH).

The FDF serves as the "home" for the passive fiber optic components from cable breakout, for connection by jumpers, to the electronics.

Fiber Distribution Unit (FDU).--An enclosure containing both a Connector Module Housing (CMH) and a Splice Module Housing enclosure.

Field Cabinet.--A roadside cabinet used for housing controllers or communications equipment.

Interconnection.--An electronic, fiber optic or electrical connection between controller unit, located inside a controller cabinet, and other components housed in other enclosures.

Jumper.--A short fiber optic cable that has connectors installed on both ends, and is typically used for connection within a FDF.

Light Source.--A portable piece of fiber optic test equipment that, in conjunction with a power meter, is used to perform end-to-end attenuation testing. It contains a stabilized light source operating at the designed wavelength of the system under test.

Link.--A passive section of the system, the ends of which are to be connected to active components. A link may include splices and couplers. For example, a video link may be from a F/O transmitter to a video multiplexer (MUX).

Mux/Demux.--Multiplexer/demultiplexer.

Optical Time Domain Reflectometer (OTDR).--Fiber optic test equipment (similar in appearance to an oscilloscope) that is used to measure the total amount of power loss between two points and the corresponding distance. It provides a visual and printed display of the relative location of system components such as fiber sections, splices and connectors and as the losses that are attributed to each component or defect in the fiber.

Patchcord.--A short jumper.

Pigtail.--Relatively short length of fiber optic cable that has a connector installed on only one end.

Power Meter.--A portable piece of fiber optic test equipment that, in conjunction with a light source, is used to perform end-to-end attenuation testing. It contains a detector that is sensitive to light at the designed wavelength of the system under test. Its display indicates the amount of power injected by the light source that arrives at the receiving end of the link.

Segment.--A section of F/O cable that is not connected to any active device and may or may not have splices per the design.

Splice Closure.--Normally installed in a splice vault, a splice closure is an environmentally sealed container used to organize and protect splice trays. The container allows splitting or routing of fiber cables from multiple locations.

Splice Module Housing (SMH).--The SMH stores splice trays as well as pigtails and short cable lengths.

Splice Tray.--A container used to organize and protect spliced fibers.

Splice Vault.--A splice vault is used to house splice closures.

Breakout.--The type of fiber optic cable containing additional strength members to allow connectors to be installed without straining the optical fibers. The cable "breakout" is produced by (1) removing the jacket just beyond the last tie-wrap point, (2) exposing 0.9 m to 1.8 m of the cable buffers, aramid strength yarn and central fiberglass strength member, and (3) cutting the aramid yarn, central strength member and the buffer tubes to expose the individual glass fibers for splicing or connection to the appropriate device.

Cable Storage Cabinet.--A cabinet for holding excess cable slack for protection. The cable storage cabinet allows the user flexibility in equipment location and the ability to pull cable back for resplicing.

Channel.--(1) An information path between a discrete input and a discrete output. (2) One single input to a multiplexer or output from a demultiplexer.

Closed Circuit Television Assembly.--Camera, lens, environmental enclosure, and necessary connectors and cables.

Connector.--A mechanical device used to provide a means for attaching to and decoupling from a transmitter, receiver, or another fiber (such as on a patch panel).

Connectorized.--A term that describes a fiber to which a connector has been affixed.

Connector Module Housing (CMH).--A patch panel used in the FDF to terminate singlemode or multimode fibers with most common connector types. It may include a jumper storage shelf and a hinged door.

Couplers.--Couplers are devices which mate two fiber optic connectors to facilitate the transition of optical light signals from one connector into another. Couplers may also be referred to as: adapters, feed-thrus, and barrels. They are normally located within FDF's mounted in panels. They may also be used unmounted, to join two simplex fiber runs.

Fiber Distribution Frame (FDF).--A rack mounted system that is usually installed in the RTMC, or in a communication HUB, that consists of a standard equipment rack, fiber routing guides, horizontal jumper troughs, fiber distribution units (FDU), connector module housings (CMH), and splice module housings (SMH). The FDF serves as the "home" for the passive fiber optic components from cable breakout, for connection by jumpers, to the electronics.

Fiber Distribution Unit (FDU).--An enclosure containing both a Connector Module Housing (CMH) and a Splice Module Housing enclosure.

Field Cabinet.--A roadside cabinet used for housing controllers or communication equipment.

Interconnection.--An electronic, fiber optic or electrical connection between controller unit, located inside a controller cabinet, and other components housed in other enclosures.

Jumper.--A short fiber optic cable that has connectors installed on both ends.

Light Source.--A portable piece of fiber optic test equipment that, in conjunction with a power meter, is used to perform end-to-end attenuation testing. It contains a stabilized light source operating at the designed wavelength of the system under test.

Link.--A specific segment of a transmission system that has a defined input and output signal. Typically a link connects two nodes of a network over a single path.

Mux/Demux.--Multiplexer/demultiplexer.

Optical Time Domain Reflectometer (OTDR).--Fiber optic test equipment that uses optical backscatter to measure the power loss between two points and the corresponding distance. It provides a visual and printed display of the relative location of system components such as fiber sections, splices and connectors and as the losses that are attributed to each component or defect in the fiber.

Patchcord.--A short jumper.

Pigtail.--Relatively short length of fiber optic cable that has a connector installed on only one end.

Ring.--A circular closed loop network topology comprising of one or more stations. Information is sequentially passed from one station to the next in the ring.

Segment.--A section of F/O.cable that is not connected to any active device and may or may not have splices per the design

Splice Closure.--Normally installed in a splice vault, a splice closure is an environmentally sealed container used to organize and protect splice trays. The container allows splitting or routing of fiber optic cables from multiple locations.

Splice Module Housing (SMH).--The SMH stores splice trays as well as pigtails and short cable lengths.

Splice Tray.--A container used to organize and protect spliced fibers.

Splice Vault.--A splice vault is used to house splice closures.

10-3.03 COST BREAK-DOWN

Cost break-downs shall conform to the provisions in Section 86-1.03, "Cost Break-Down," of the Standard Specifications and these special provisions.

The Engineer shall be furnished a cost break-down for each contract lump sum item of work described in this Section 10-3.

The cost break-down shall be submitted to the Engineer for approval within 15 days after the contract has been approved. The cost break-down shall be approved, in writing, by the Engineer before any partial payment for the items of electrical work will be made.

The cost breakdown shall include the following items in addition to those listed in the Standard Specifications:

communication pull boxes and splice vaults- each type
telephone bridges
terminal blocks- each type
data and video node controller cabinet enclosures
single fiber optic video transceivers
highway advisory radio

10-3.04 EQUIPMENT LIST AND DRAWINGS

A maintenance manual shall be furnished for all installed controller units, CCTV camera, single fiber optic video transceivers and auxiliary equipment. The maintenance manual and operation manual may be combined into one manual. A verified (accurate) and validated (correlated) maintenance manual or combined maintenance and operation manual shall be submitted at the time the controllers are delivered for testing or, if ordered by the Engineer, prior to purchase. In the event errors are uncovered in the course of testing, the contractor shall assist in the resolution of the discrepancies, and provide the updated data. The maintenance manual shall include, but not be limited to, the following items:

- A. Specifications (including input/output functions with tolerances)
- B. Design characteristics
- C. General operation theory
- D. Function of all controls
- E. Trouble shooting procedure (diagnostic routine) with test points as applicable
- F. Block circuit diagram
- G. Geographical layout of components in wiring diagrams
- H. Schematic diagrams
- I. List of replaceable component parts with suppliers and their stock numbers

FIELD CABINETS - Each field cabinet which is connected to the communication system under this contract shall be supplied with the following documentation, as it relates to this project, stored in a re-sealable water resistant folder mounted on the inside of the field cabinet door:

CCTV CAMERA

- A copy of the video channel assignment table
- A copy of the fiber assignment tables
- A copy of the twisted pair assignment tables
- A copy of the system schematic diagrams
- A copy of the element reference table

VIDEO NODE

- A copy of the final fiber assignment tables
- A copy of the final system schematic diagrams
- A copy of the element reference table

DATA NODE

- A copy of the final fiber assignment tables
- A copy of the final system schematic diagrams
- A copy of the element reference table

Additional information may be supplied by the Engineer to be used to produce the documentation listed above by adding the related information that applies to this project.

Full compensation for the maintenance manual and field cabinet documentation shall be considered as included in the contract lump sum price paid for system testing and documentation, and no separate payment will be made therefor.

10-3.05 MAINTAINING EXISTING AND TEMPORARY ELECTRICAL SYSTEMS

No ramp metering or traffic monitoring station controller shall be disconnected or disrupted between the hours of 6:00 a.m. and 9:00 a.m., and from 3:00 p.m. to 7:00 p.m., Mondays through Fridays.

No ramp metering or traffic monitoring station controller shall be disconnected from its electrical power for more than 15 minutes in any 24 hour period without prior written approval from the Engineer.

No more than five individual Model 170 Controller locations, each with its own unique controller I.D. number, as indicated on the plans, shall be subject to disruption at any time during the system cutover.

The Contractor shall obtain written approval from the Engineer, not less than 72 hours prior to any system cutover, testing, disconnection or disruption of service from the existing fiber optic communication system, ramp metering system, traffic monitoring system and lighting and sign illumination.

10-3.06 FOUNDATIONS

Foundations for CCTV camera poles and CMS sign structures shall conform to the provisions on Section 86-2.03, "Foundations," of the Standard Specifications.

Full compensation for cast-in-drilled-hole concrete foundation (for CCTV poles) shall be considered as included in the contract lump sum prices paid for closed circuit television cameras at various locations and no separate payment will be made therefor.

10-3.07 CONDUIT

Conduit, including conduit for power conductors, in jacking runs, masonry walls and sidewalks and conduit from pull boxes and splice vault to cabinets and junction boxes in or on structures to be installed underground shall be Type 1 unless otherwise specified and shall not be exposed in any areas. The Contractor shall install pull ropes in all empty conduits and innerducts. Detector termination conduits shall be Type 1.

Type 3 conduit shall be used for communication trunk line, including runs in elevated concrete slabs, except as shown on plans, and shall not be exposed in any areas.

Conduit shall be installed by the methods shown on the plans except as specified in these special provisions and as directed by the Engineer. A flat, woven, lubricated, polyester tape with a minimum tensile strength of 80106 N minimum shall be placed in all conduits. At least four feet of tape shall extend beyond the termination. At least 1.2 m of tape shall be extended beyond termination.

The conduit in a foundation and between a foundation and the nearest pull box shall be Type 1.

Conduit sizes shown on the plans and specified in the Standard Specifications and these special provisions are referenced to metallic type conduit. When rigid non-metallic conduit is required or allowed, the nominal equivalent industry size shall be used as shown in the following table:

Size Designation for Metallic Type Conduit	Equivalent Size for Rigid Non-metallic Conduit
21	20
27	25
41	40
53	50
63	65
78	75
103	100

When a standard coupling cannot be used for joining Type 1 conduit, a UL listed threaded union coupling conforming to the provisions in Section 86-2.05C, "Installation," of the Standard Specifications, shall be used.

When Type 3 communication conduit is placed in a trench after the bedding material is placed and the conduit is installed, the trench shall be backfilled with cement slurry backfill conforming to the requirements in Section 19-3.062 of the Standard Specifications, except the maximum size of aggregate shall be 10 mm (pea gravel) containing not less than 150 kg/m³ of Portland cement and commercial quality cement sand, to not less than 50 mm above the conduit before additional backfill material is placed.

In those areas where a jacking pit in a concrete shoulder is necessary to jack conduit across a roadway and the work has not been completed in a work shift, the Contractor shall backfill the pit. Surface of pit shall have no less than 10 mm gap after each completed work day. When the work has been completed in a particular jacking area, the surface must be restored to its original condition.

When conduit is placed in a trench under paved shoulders, after the bedding material is placed and conduit installed, the trench shall be backfilled with cement slurry backfill as specified above to within 30 mm of existing shoulder surface.

Conduits located within the same trench shall have not less than 50 mm separation.

Trenches shall be less than or equal to 200 mm width.

The Contractor's attention is directed to "Aerially Deposited Lead" elsewhere in these special provisions.

Immediately prior to installing conductors, cables and innerducts, all conduits shall be blown out with compressed air until all foreign material is removed. After conductors and cables have been installed, the ends of conduits terminating in pull boxes, service equipment enclosures and controller cabinets shall be sealed with an approved type of sealing compound.

After conductors have been installed, the ends of conduits terminating in various pull boxes and splice vaults, service equipment enclosures, and various controller cabinets shall be sealed with an approved type of sealing compound.

At those locations where conduit is required to be installed under pavement and existing underground facilities require special precautions in conformance with the provisions in "Obstructions" of these special provisions, conduit shall be placed by the "Trenching in Pavement Method" in conformance with the provisions in Section 86-2.05C, "Installation," of the Standard Specifications.

Conduit shall not be installed by trenching along the pavement of freeway lanes except in those section of the highway where there is insufficient clearance to locate a longitudinal trench off the traveled way, or where obstructions off the traveled way would necessitate bends in the conduits in excess of those allowed.

Where conduits are shown on the plans to be installed parallel and adjacent to each other, they shall be installed together in a common trench as shown on the conduit installation details. Should the Contractor choose to install the conduits in separate trenches, only the "shared trench" quantities of trenching will be paid.

Power conduits placed in the same trench as communication conduits shall not terminate in communication pull boxes or splice vault.

Communication conduits shall not terminate in power pull boxes.

Trenching shall not be allowed across freeway lanes, connectors and ramps.

COMMUNICATION CONDUIT

Communication conduit shall conform to the provisions specified above under "Conduit" and the following.

Conduit shall enter splice vault and communication pull boxes through knockouts. Conduits entering the ends of these boxes shall be vertically and horizontally aligned with the conduits at the opposite end of the box. Conduit ends shall not extend beyond the interior wall face of splice vault and pull boxes. The space around conduits through end walls of splice vault and communication pull boxes shall be filled with Portland cement mortar conforming to the provisions in Section 51-1.135, "Mortar," of the Standard Specifications. In no case shall a conduit body or pull box be used in lieu of a specified bend to change the direction of the communication conduit run, except where specified.

No bends shall be placed in a section of conduit in excess of those indicated in the plans without the approval of the Engineer. The total degrees of bending in a section of conduit between splice vaults and communication pull boxes shall not exceed a total of 180 degrees, except where specified otherwise.

Changes in indicated conduit bends may be made in order to suit field conditions, as long as the change reduces the degree of the bend or increases the radius of the bend. In no case shall the angle of the bend be increased without the approval of the Engineer.

Minimum bending radius for Size 53 communication conduit shall be 610 mm and minimum bending radius for Size 103 communication conduit shall be 1220 mm. Bends of greater than 22 degrees shall be factory bends and bends greater than 45 degrees shall galvanized rigid steel with any necessary adapters.

Deflections from the indicated communication conduit routing to avoid obstructions shall not exceed 83.3 mm/m. Conduit from the typical trench sections shall not deflect by more than 83.3 mm/m from the alignment preceding or following pull boxes and splice vault.

The total sum of bend radius for the communication conduit between consecutive communication pull boxes or splice vault shall not exceed 360 degrees.

Where edge drains are in the path of conduit routing the Contractor must first locate the edge drains and install the conduit maintaining a minimum depth. In the event an edge drain is damaged by the Contractor's work, the Contractor will be responsible for a full repair at his cost.

Adjacent to over crossings or bridge foundations, the Contractor shall trench and install conduit in the shoulder as close as possible to the edge of traveled way so that a minimum of 1.5 m from the outside face of footing or pile cap is maintained.

Colored Cement Backfill: The slurry cement backfill for the installation of communication conduits that will contain fiber optic cable shall be a medium to dark, red or orange color to clearly distinguish the concrete backfill from other concrete and soil. The concrete shall be pigmented by the addition of commercial quality cement pigment to the concrete mix. The red or orange concrete pigment shall be LM Scofield Company; Orange Chromix Colorant; Davis Colors; or equal.

For trenches in pavement areas, only the top 100 mm of slurry cement backfill will be required to be pigmented concrete. At the option of the Contractor, the full depth may have the pigment.

Full compensation for furnishing and incorporating the cement pigment to achieve the color required shall be considered as included in the contract price paid per meter for the various sizes and types of conduit involved and no separate payment will be made therefor.

COMMUNICATION CONDUIT (BRIDGE)

At the locations shown on the plans, where communication conduit is to be installed on bridges, fiberglass conduit or steel conduit shall be used and shall conform to the details shown on the plans, and to these special provisions. Communication conduit (bridge) shall include excavation, installation of the fiberglass or steel conduit, and placing sand and slurry cement backfill.

Excavation and slurry cement backfill shall conform to Section 19-3, "Structure Excavation and Backfill," of the Standard Specifications. The slurry cement backfill shall reach initial set prior to placing of reinforced concrete for the approach slab.

MEASUREMENT.- Communication conduit (bridge) will be measured by the meter.

STEEL CONDUIT (BRIDGE)

Steel conduit shall be used for the limits shown on the plans for L.A. River Undercrossing (Bridge No. 53-0255) and Taylor Yard Overhead (Bridge No. 53-1039)

Steel conduit shall be Type 1 and shall conform to the provisions in Section 86-2.05, "Conduit," of the Standard Specifications.

FIBERGLASS CONDUIT

General: Fiberglass conduit and components shall comply with the specifications in ANSI/NEMA Standards Publication TC-14A or TC-14B. All fiberglass conduit components shall be free of defects including delaminations, foreign inclusions, etc. All fiberglass conduit components shall be nominally uniform (as commercially practical) in color, density, and physical properties. Fiberglass conduit shall be straight and the ends shall be cut square and true.

The Contractor shall purchase all fiberglass conduit and other fiberglass conduit system components from the same manufacturer to insure component compatibility.

Conduit Sizes: Fiberglass conduit shall be supplied in 6 m minimum lengths.

System Components: Fiberglass conduit components shall include compatible fittings, adapters, expansion joints, and factory bends at nominal radii of 0.6 m, 1 m, and 1.3 m for Size 53, 78 and 103 conduits, respectively.

Material: All fiberglass conduit system components shall be produced from heat cured, corrosion resistant epoxy resin and continuous fiberglass roving. All materials shall be manufactured for use at temperatures from -40°C to 110°C. All fiberglass conduit components shall be manufactured using a homogeneously dispersed UV inhibitor. When exposed to direct diurnal sunlight, the UV inhibitor shall prevent the degradation of all physical material properties, except for surface cosmetic appearance. Materials shall contain no halogens above trace levels and shall be fire resistant.

Joining Method: Joints shall be water tight and withstand a minimum 4450 N of pullout tension.

Stiffness: For all sizes of fiberglass conduit, under a load of 1.3 kN/m of conduit, the deflection of the inside diameter shall not exceed 5 percent.

Impact Resistance: The minimum impact resistance values for the fiberglass conduit shall be as follows when measured as described in ASTM Designation: D2444-70, using a 9 kg.tup "B" with a 50 mm radius nose:

Size 53 conduit	40 N/m.
Size 78 conduit	68 N/m.
Size 103 conduit	108 N/m.

HANGERS AND CONCRETE SUPPORTS (BRIDGE)

Wrapping tape for pipe in contact with the earth shall be a pressure sensitive polyvinyl chloride or polyethylene tape with a minimum thickness of 1.27 mm.

Pipe hanger assemblies shall consist of a concrete clevis plate or embedded steel welded linked eye rods, an adjustable steel yoke, a cast iron pipe roller, a steel roller rod and hex nuts. Parts shall be galvanized. The pipe hanger assembly shall be suitable for the type and size of pipe installed and shall be as shown on the plans.

Steel hangers, anchor bolts, pipe clamps, nuts and bolts, and other fittings shall be suitable for the type and size of the supply lines or casing and shall conform to the provisions in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications.

Concrete pipe supports shall consist of a precast concrete pipe cradle, galvanized steel pipe clamp, 2 anchor bolts and, where shown on the plans, a stainless steel pipe protection shield.

Concrete pipe supports and pipe stops shall conform to the dimensions shown on the plans and shall be constructed of commercial quality concrete with a cement content not less than 350 kg/m³ of portland cement and commercial quality wire mesh. The concrete for pipe supports and pipe stops shall be moist cured for not less than 3 days.

Epoxy adhesive shall conform to the provisions in Section 95-1, "General," of the Standard Specifications and at the option of the Contractor, shall conform to the provisions in Section 95-2.03, "Epoxy Resin Adhesive for Bonding New Concrete to Old Concrete," or in Section 95-2.04, "Rapid Set Epoxy Adhesive for Pavement Markers," or in Section 95-2.05, "Standard Set Epoxy Adhesive for Pavement Markers," of the Standard Specifications.

PAYMENT.-Full compensation for furnishing and installing mechanical expansion bolt anchors, steel hangers, steel brackets and other fittings, concrete supports, pipe wrapping tape, epoxy-adhesives, and conduit expansion fittings shall be considered as included in the contract price paid per meter of communication conduit (bridge) involved and no additional compensation will be allowed therefor.

10-3.08 WARNING TAPE

Warning tape shall be furnished and installed in the trench, over new conduits to receive reinstalled or new fiber optic cables, as shown on the plans. The warning tape shall consist of 100 mm wide bright orange pigmented polyolifin film with a bold printed message of approximately 19 mm black characters on one side. The message shall be: "CAUTION: BURIED FIBER OPTIC CABLE - CALTRANS (213) 897-0340," repeated at approximately 910 mm intervals.

The warning tape shall not delaminate nor shall the message smear when wet. The tape and the printed message shall be resistant to insects and shall not degrade when exposed to alkalis, acids and other corrosive elements commonly found in soil. It shall have a minimum of 356 N tensile strength and a minimum of 700 percent elongation before breakage.

Warning tape shall be Condux International, Inc.; Allen System, Inc.; Reef Industries, Inc. or equal.

Full compensation for warning tape shall be considered as included in the contract price paid per meter for the various sizes and types of conduit involved and no separate payment will be made therefor.

10-3.09 FIBER UNDER GROUND WARNING SIGN

Any communication conduit installed in soil where conduit can not be seen from above ground for more than 30 m must have a warning sign. The signs must be placed within 5 m of conduit at minimum 60 m intervals.

The signs shall say "FIBER UNDER GROUND CALL 213-897-4698 CALTRANS ITS DEPT." The dimensions of the signs shall be at a minimum of 130 mm x 170 mm x 2 mm and made of galvanized sheet metal or aluminum sheet. The sign colors shall be white lettering with black background. The signs shall be bolted to right of way fence at a height of 1.5 m. In the event the right of way fence is not within 5 m from conduit installation, then contractor shall install signs on a metal post, see A73B in the standard plans.

Full compensation for furnishing fiber underground warning sign shall be considered as included in the price or prices paid for the conduit involved and no separate payment will be made

10-3.10 SIZE 32 INNERDUCT

Wherever fiber optic cable is used, innerduct shall be installed to provide protection for the fiber optic cable. A separate innerduct shall be installed for each fiber optic cable along the communication mainline as shown on the plans.

All innerduct shall be 32 mm, smooth, ribbed or corrugated high tensile polyethylene duct. Innerduct shall have the following characteristics:

- Inner diameter greater than or equal to 32 mm, nominal.
- Environmental stress crack resistance in excess of 2000 hours at - 100°C, no failures.
- Cold impact resistance to -76°C not brittle until -100°C.
- Minimum tensile strength of 2670 N for finished product.
- Minimum crush strength of 2900 N.
- Coefficient of friction shall be less than 0.4 unlubricated on nonmetallic conduit and with common polyethylene cable jackets.

Different innerducts within the same conduit shall be different colors, and shall be consistent throughout the project. The colors shall be yellow for the 24 SMFO fiber optic cables used for video/data and contrasting color approved by the Engineer for the 72 SMFO for video distribution. The exterior of the innerduct shall be marked with sequential measurement markings each meter.

Innerduct shall be installed using the manufacturer's recommended practices. A manufacturer recommended lubricant shall be applied between the innerduct and the conduit during installation to reduce friction. Innerduct shall be installed using a cable pulling lubricant recommended by the innerduct manufacture and a non-abrasive pull tape conforming to the provisions described under "Conduit" elsewhere in these special provisions. If innerduct is to be installed with adjacent cables in the same conduit, the innerduct and the cable shall be installed together in one operation. Innerduct shall be installed in continuous runs between communication pull boxes and splice vaults without splices or joints.

All ends shall be smoothed to prevent scraping of the cable. A dynamometer shall be used to record installation tension and a tension limiting device shall be used to prevent exceeding the maximum pulling tension during installation. A fusible link shall be used to limit the pulling tension. One link shall be placed in series with every element rated for less than the maximum pulling tension of that element. The innerduct shall not be stressed beyond the minimum bending radius allowed by either the innerduct or fiber optic cable manufacturer.

The tension shall be set to the manufacturer's maximum limit. The maximum pulling tension shall be recorded for each innerduct run.

Immediately prior to installing cables, innerduct shall be blown out with compressed air until all foreign material is removed. After cables have been installed, the ends of innerducts shall be sealed with an approved type of sealing compound.

10-3.11 PULL BOXES

Grout shall not be placed in the bottom of pull boxes.

Additional pull boxes for communication system routing shall not be installed without the Engineer's written approval. All pull boxes for communication system routing shall be installed in the unpaved area immediately adjacent to the paved shoulder or behind guard railing or to be determined by the Engineer. Communication conduit shall be directed from the shoulder to the boxes with 15 degree (maximum) sweeps where conduit is installed on the shoulder. Dikes shall be replaced in kind, as necessary.

Full compensation for replacing the dikes shall be considered as included in the contract price paid per meter for the various sizes and types of conduit involved and no additional compensation will be allowed therefor.

COMMUNICATION PULL BOXES

Communication pull boxes and covers shall have a vertical proof-load strength of 111KN. The 111 KN load shall be distributed through a 229-mm x 229-mm x 51-mm steel plate according to Federal Specification RR-F-621e. This load shall be placed anywhere on the box and cover for a period of one minute without causing any cracks or permanent deformations.

The communication pull boxes shall be reinforced with a galvanized Z-bar welded frame and cover similar to that shown on the plans for No. 6(T)pull boxes. Frames shall be anchored to the boxes by means of 6-mm x 57-mm long concrete anchors. Six concrete anchors shall be provided for each communication pull box, one placed in each corner and one placed near the middle of each of the longer sides.

Hold down screws shall be 9-mm hex flange cap screws of Type 316 stainless steel. The nut shall be zinc plated carbon steel and shall be made vibration resistant with a wedge ramp at the root of the thread. The nut shall be spot welded to the underside of, or fabricated with, the galvanized Z-bar pull box frame.

Steel covers shall be countersunk approximately 6-mm to accommodate the bolt head. The bolt head shall not extend more than 3-mm above the top of the cover when tightened down. A 6 mm tapped hole and brass bonding screw shall be provided.

Communication pull boxes shall have " CALTRANS COMMUNICATION" marking on the steel cover.

The opening of communication pull boxes shall have the following dimensions.

Pull Box Type	Width (±25 mm)	Length (±25 mm)
Communication	432 mm	762 mm

Concrete placed around and under communication pull boxes as shown on the plans shall contain a minimum of 325 kg of cement per cubic meter.

After the installation of communication pull boxes, the steel covers shall be installed and kept bolted down during periods when work is not actively in progress at the pull box. When placing the steel cover for the final time, the cover and the Z-bar frame shall be cleaned of all debris and securely tightened down.

Communication pull boxes shown on the plans in the shoulder are shown for general location only. The exact location shall be outside the paved shoulder and shall be determined by the Engineer.

Communication pull boxes will be measured as units determined from actual count in place. Communication pull boxes to be paid for as units shall be those units designated on the plans or ordered by the Engineer. Additional communication pull boxes shall not be installed without the Engineer's written approval.

10-3.12 SPLICE VAULT

Splice vault shall be 1520 mm (L) x 760 mm (W) x 760 mm (D) nominal inside dimensions and shall conform to Section 86-2.06, "Pull Boxes," of the Standard Specifications. Covers shall be in one or two sections. Hold down bolts or cap screws and nuts shall be of brass, stainless steel or other non-corroding metal material. Each cover portion shall have inset lifting pull slots. Cover marking shall be "CALTRANS COMMUNICATION" on each cover section. Enclosures, covers and extensions shall be concrete gray color. Vault and covers may be constructed of reinforced Portland cement concrete or of non-Portland Cement Concrete material.

Non-PCC vault and covers shall be of sufficient rigidity that when a 445 N concentrated force is applied perpendicularly to the midpoint of one of the long sides at the top while the opposite long side is supported by a rigid surface, it shall be possible to remove the cover without the use of tools. When a vertical force of 6675 N is applied, through a 13-mm by 75-mm by 150-mm steel plate, to a non-Portland Cement Concrete cover in place on a splice vault, the cover shall not fail and shall not deflect more than 6-mm.

Splice vault shall be installed as detailed and where shown on the plans. Splice vault and cover shall have an AASHTO HS 20-44 rating where shown on the plans., except in the area protected from vehicular traffic, as directed by the Engineer, may be rated for AASHTO H5 loads (25 percent of HS 20-44):

- Behind structures, retaining walls, barrier railing or guard railing.
- In sidewalk areas.
- In other areas protected from vehicular traffic as directed by the Engineer.

Splice vault shall be installed 24-mm above grade in unpaved area.

Splice vaults shown on the plans in the shoulder are shown for general location only, exact location shall be directed by the Engineer.

Metallic or non-metallic cable racks shall be installed on the interior of both sides of the splice vault. The rack shall be capable of supporting a load of 445 N, minimum, per rack arm. Racks shall be supplied in lengths appropriate to the box in which they will be placed. Rack arms shall not be less than 150 mm in length. All metallic cable racks shall be fabricated

from ASTM Designation: A36 steel plate and shall be hot-dip galvanized after fabrication. Steel plate, hardware and galvanizing shall be in accordance with the requirements of Section 75, "Miscellaneous Metal," of the Standard Specifications. Metallic cable racks shall be bonded and grounded.

10-3.13 CONDUCTORS AND WIRING

Splices shall be insulated by "Method B" The minimum insulation thickness, at any point, for Type USE, RHH or RHW wire shall be 1.0 mm for conductor sizes No. 14 to No. 10, inclusive, and 1.3 mm for No. 8 to No. 2, inclusive. The minimum insulation thickness, at any point, for Type THW and TW wires shall be 0.69 mm for conductor sizes No. 14 to No. 10, inclusive, 1.02 mm for No. 8, and 1.37 mm for No. 6 to No. 2, inclusive.

Full compensation for power cables of the sizes shown on plans shall be considered as included in the contract prices paid for the various items of work involved and no additional compensation will be allowed therefor.

TWISTED PAIR CABLE

Twisted pair cable shall be supplied in the configurations shown on the plans and specified in these special provisions. The twisted pair cable shall meet the requirements of REA Specification PE-39 and the following:

Conductors shall consist of a solid wire of plain annealed high conductivity copper, smoothly drawn, circular in section, uniform in quality, free from defects and having a conductor size of number 22 AWG. Each conductor shall be insulated with a colored, high density polyethylene jacket.

Insulated conductors shall be uniformly twisted to form pairs. The twisted length of the pairs shall vary to minimize cross talk. A non-hygroscopic dielectric tape shall be wrapped around the insulated pairs. A laid up core shall be wrapped with aluminum tape and bonded with an overlap to provide 100 percent shielding. A black, high molecular weight, medium or low density, polyethylene jacket shall be extruded over the shield. Filling compound materials used in the cable shall not support galvanic action.

The cables shall be color-coded using the REA standard color code.

Packing.--The cable shall be supplied on reels. Each reel shall be transported to the site using cable reel trailers and shall have the following information clearly labeled on it:

- Customer.
- Customer order number.
- Reel number.
- Destination.
- Ship date.
- Manufactured date.
- Manufacturer's name.
- Cable code.
- Length of cable.
- Manufacturers Test Data

Cable shall be transported to the project site using cable reel trailers. Care shall be taken at all times to avoid scraping, denting, or otherwise damaging the cable before, during or after installation. Damaged cable shall be replaced by the Contractor without additional compensation.

Installation.--Cable shall be installed in duct in the field in accordance with the plans. Duct ends shall have all rough ends smoothed to prevent scraping the cable. A manufacturer recommended lubricant shall be applied to the cable to reduce friction between the cable and the duct. Mechanical aids and pulling cable or ropes shall be used as required. Personnel shall be stationed at each cabinet, splice vault and pull box through which the cable is to be pulled to observe and lubricate the cable. All exposed cable ends shall be protected from moisture ingress.

The cable shall not be stressed beyond the manufacturer's minimum bending radius at any time. A dynamometer shall be used to measure installation tension and a tension limiting device shall be used to prevent exceeding the manufacturer's maximum pulling tension specification during installation. The tension limit shall be set at or below the manufacturer's maximum limit. The maximum measured pulling tension shall be recorded for each run of cable.

A single loop of cable with a minimum length of 3.0 m, shall be provided at each pull box in accordance with the plans. Cable shall be trained to the splice vault wall opposite any power cables, tied with nylon ties and labeled with vinyl marking bands.

A minimum of 12 m of slack shall be provided for each unspliced cable at each splice vault.

Following installation of the cable in the duct, all duct entrances at pull boxes, vaults and cabinets shall be sealed with duct sealing compound to prevent the ingress of moisture, foreign materials, and rodents. The cables shall be spliced, maintaining the pair count and REA color code. Cable markers shall be used to identify the cable and pair count. All field splices shall be made in twisted pair splice closures located in the splice vaults. The cable shall be securely fastened in place within pull boxes, vaults and cabinets.

Testing.--The Contractor is responsible for all testing and documentation required to establish approval and acceptance of the cable, its installation and in operation during the system integration testing. The following identifies the specific quality control requirements for this specification.

Cables shall be tested at the factory to ensure the cable complies with the manufacturer's specifications. The Contractor shall record the reel number from which the cable came, the identification of the pairs measured, and the results of continuity and insulation tests. Half of the twisted wire pairs in each reel of cable shall be tested for insulation breakdown and continuity prior to installation in ducts.

As a post-installation check, the Contractor shall measure the continuity and insulation resistance of the cable pairs in each length of cable after installation. The Contractor shall measure these parameters on each pair and record and submit the results to the Engineer.

The Contractor shall carry out system integration testing to ensure that the twisted-pair cables perform as specified when used in operation with equipment installed under these special provisions and plans.

10-3.14 TERMINAL BLOCK.

The protected terminal blocks shall have replaceable protector modules and be installed in equipment cabinets.

Terminal Blocks - 6, 12 and 50 Pair--Terminal blocks shall terminate twisted-pair communications cables and each pair shall terminate on distinct terminals using either punch-down or compression, screw-down terminals. Each terminal block shall terminate either 6 pairs, 12 pairs or 50 pairs as shown on the plans. The terminal blocks shall include solid state, over-voltage protection consistent with REA Telecommunications Bulletin 344-2 or Bellcore TR-TSY-000299.

The terminals shall terminate wire sizes from No. 22 AWG to No. 18 AWG, and have a current rating of not less than 2 A. Terminal blocks installed in field equipment cabinets, including but not limited to, ramp metering and traffic monitoring (count) stations, traffic signals, and CCTV camera locations, shall be 12-pair protected terminal blocks. Terminal blocks shall be installed at data nodes, video nodes and cable nodes, and shall be protected premises entry type, and use an AT&T, 4C-S, 5-pin plug-in type protector or equivalent.

Terminal blocks shall be systematically arranged inside the cabinet to allow termination of cables. The terminal block and the station-protection modules shall be properly installed along the lower side of the equipment cabinet, opposite the power terminations.

Each pair of the incoming twisted-pair communications cables shall be properly terminated inside the equipment cabinet as indicated in the schematics and twisted-pair splice tables. Terminations shall be made sequentially and no more than one wire from the communications cable shall be connected to one terminal and marked properly to show the pair number.

All cable cores shall be labeled with cable markers at each end for proper core identification.

Terminal Protector.--The terminal protector incorporated in the terminal blocks shall be field installable and replaceable solid state over-voltage protection (SSOVP) module. The SSOVP shall have tin-alloy plated outside plant, central office and grounding pins. The SSOVP will operate in the 300 VDC surge range with a response time of less than 20 nanoseconds.

The solid state over-voltage protection (SSOVP) module is a 5-pin unit that will be installed in a C-310 style terminal block. The SSOVP will have an on-state voltage of less than 5 V at 100 A within 10 microseconds.

10-3.15 TWISTED PAIR SPLICE CLOSURE

Twisted-pair splice closures shall come in two sizes; 305 mm and 610 mm. The closures shall be installed inside communications pull boxes or splice vaults for every drop from the twisted-pair trunk cable to an equipment location and at mid-span splices as shown on the plans and shall conform to the following.

The twisted-pair splice closure shall consist of a neoprene sleeve, and shall be secured with hose clA.

The twisted-pair splice closure shall have external dimensions not exceeding 610 mm in length by 76 mm in diameter. In the pull boxes, the length shall be limited to 305 mm. The twisted-pair splice closure shall consist of a neoprene sleeve, and shall be secured with hose clA. The closure shall protect the cable splices from water and mechanical damage and shall be resistant to salt corrosion. All material of the twisted-pair splice closure and associated mounting accessories shall be non-reactive and the completed assembly shall not support galvanic cell action. The twisted-pair splice closure shall be waterproof, encapsulated with re-enterable material, and shall be sealed with a gasket. Wire connections shall be of the

insulation displacement type with water blocking gel (3-M Scotchlocks, AMP Pica-bonds or equal). The manufacturer's instructions shall be explicitly followed during installation of the twisted-pair splice closure.

The closure shall be mounted securely inside the communications pull box or vault as shown on the plans. The closure shall be properly grounded and the cable sheaths bonded using bonding cIA. The trunk cables shall be identified as "IN" or "OUT" depending upon their location relative to the splice (toward the communications node or away from the communications node). A tape collar shall be placed around the two trunk cables and the drop cable at the location required by the splice closure. The splice closure shall be fitted to the splice and the hose cIA tightened over the cables.

Each pair of the drop cable shall be properly spliced to the designated pair in the trunk cable as indicated in the twisted-pair splice tables. The splice conductors shall be securely crimped onto the wires, using manufacturer approved installation tools.

The closures shall be provided along with a splice kit, which shall contain all hardware items. Hardware shall include, but not be limited to, vinyl tape, bonding cIA, splice connectors, No. 14 AWG, insulated wire, spacer tapes, and terminal lugs.

Continuity shall be tested and confirmed prior to final assembly of the splice closure. After installing, splicing, and terminating the twisted-pair communication cables the Contractor shall test the cables for grounds, shorts, splits, and opens. The Contractor shall measure and record the loop resistance from the adjacent data node for all pairs at each terminal location. This resistance shall not exceed 34 per 305 m. The Contractor shall record all data and shall correct any problems per manufacturer's instruction. The Contractor shall record all data for review by the Engineer.

10-3.16 SERVICE

Continuous welding of exterior seams in service equipment enclosures is not required.

Circuits with Model 500 changeable message signs shall have service equipment enclosures which have main busses and terminal lugs rated for 100 A, minimum, and a No. 2 bare copper ground wire.

Each service shall be provided with up to 2 main circuit breakers which shall disconnect ungrounded service entrance conductors. Where the "Main" circuit breaker consists of 2 circuit breakers as shown on the plans or required in the special provisions, each of the circuit breakers shall have a minimum interrupting capacity of 10 000 A, rms.

An engraved phenolic nameplate shall be installed with stainless steel rivets on the exterior of the front panel indicating the identification number and the service address of the service cabinet enclosure. Character size shall be a minimum of 5 mm in height.

Service conduits between the utility owned power poles and the service equipment enclosures shall not be installed until service locations have been verified by the serving utility.

Where a new service is to be installed, the Contractor shall notify the Engineer in writing at least five working days prior to the date service is required.

Full compensation for Type III-BF and Type III CF service equipment enclosures shall be considered as included in the contract prices paid for the various items requiring service equipment enclosures, as shown on the plans, and no additional compensation will be allowed therefor.

Transformers.--The transformers shall be dry type, encapsulated, rated at 120 V and have a minimum KVA rating as indicated on the plans. The transformers shall be installed in a No 6(E) pull box and be provided with a handle and a hanger. The transformers shall be of the totally enclosed non ventilated submersible type and comply with Section 86-6.09C of the Standard Specification.

Full compensation for transformers shall be considered as included in the contract lump sum price paid for Traffic Monitoring Station (Location 2458) as shown on the plans and no additional compensation will be allowed therefor.

10-3.17 NUMBERING ELECTRICAL EQUIPMENT

Self-adhesive reflective numbers and edge sealer will be State-furnished in conformance with the provisions in "Materials" of these special provisions.

The numbers and edge sealer shall be placed on the equipment where designated by the Engineer.

Where new numbers are to be placed on existing or relocated equipment, the existing numbers shall be removed.

Reflective numbers shall be applied to a clean surface. Only the edges of the numbers shall be treated with edge sealer.

Five-digit, self-adhesive equipment numbers shall be placed for all service pedestals. On service pedestals, the numbers shall be placed on the front door.

10-3.18 MODEL 170 TYPE 334-TV CONTROLLER ASSEMBLIES

Model 170 Type 334 -TV controller assemblies for closed circuit television system and cable node and video node shall be furnished by the Contractor and shall conform to the provisions in Section 86-3.03, "Model 170 and Model 2070 Controller Assemblies," of the Standard Specifications and these special provisions.

The Contractor shall arrange to have a signal technician, qualified to work on the controller unit and employed by the controller unit manufacturer, or the manufacturer's representative, present at the time the equipment is turned on.

The Contractor shall construct each controller cabinet foundation as shown on the plans for Model 332 and 334 cabinets (including furnishing and installing anchor bolts), shall install the controller cabinet on the foundation, and shall make field wiring connections to the terminal blocks in the controller cabinet.

Foundations for Type 1 housing shall conform to the details on Standard Plan ES-3C for Model 332 and 334 cabinets.

10-3.19 STATE-FURNISHED MODEL 170 TYPE 334 CONTROLLER ASSEMBLIES

The Model 170 Type 334 controller assemblies, including controller unit, completely wired controller cabinet and inductive loop detector sensor units, but without anchor bolts, for ramp metering and traffic monitoring station systems will be State-furnished as provided under "Materials" of these special provisions.

The Contractor shall construct the controller cabinet foundation as shown on the plans for Model 334 cabinets (including furnishing and installing anchor bolts), shall install the controller cabinet on the foundation, and shall make field wiring connections to the terminal blocks in the controller cabinet.

A listing of field conductor terminations, in the State-furnished controller cabinet, will be furnished free of charge to the Contractor at the site of the work.

State forces will maintain the controller assemblies. The Contractor's responsibility for controller assemblies shall be limited to conforming to the provisions in Section 6-1.02, "State-Furnished Materials," of the Standard Specifications.

10-3.20 TELEPHONE BRIDGE

Telephone bridges shall conform to the provisions in Section 86-3.07A, "Telephone Bridge," of the Standard Specifications and these special provisions.

Each telephone bridge shall be installed inside the controller cabinet as shown on the plans.

Full compensation for furnishing all labor, materials, tools, equipment, and incidentals required to provide fully equipped and operating system, and for doing all the work involved in the telephone bridges, as shown on the plans, shall be considered as included in the contract prices paid for the various items of work requiring telephone bridges and no additional compensation will be allowed therefor.

10-3.21 DETECTORS

Loop detector lead-in cable shall be Type B.

Inductive loop detector shall be Type E. For Type E detector loops, sides of the slot shall be vertical and the minimum radius of the slot entering and leaving the circular part of the loop shall be 40 mm. Slot width shall be a maximum of 20 mm. Loop wire for circular loops shall be Type 2. Depth of slots of circular loops shall not exceed the depth of pavement as shown on the plans and shall be filled with hot melt rubberized asphalt sealant. Inductive loop detector shall be installed only after pavement striping is completed.

The depth of loop sealant above the top of the uppermost loop wire in the sawed slots shall be as shown on the plans. The saw cut depth shall have a maximum as shown in the plans.

Full compensation for loop detectors shall be considered as included in the contract prices paid for the various items of work requiring loop detectors and no additional compensation will be allowed therefor.

10-3.22 MODEL 500X CHANGEABLE MESSAGE SIGN SYSTEM

Model 500X changeable message sign (CMS) systems consist of a Model 500X changeable message sign, a Model 170 controller assembly in a completely wired Type 1 or similar cabinet and the required wiring and auxiliary equipment required to control the CMS shown on the plans and in conformance with these special provisions.

The Model 500X changeable message signs, wiring harness and Model 170 controller assembly including controller unit and completely wired cabinet, but without anchor bolts, will be State-furnished in conformance with the provisions in "Materials" of these special provisions.

Attention is directed to "Sign Structures" of these special provisions.

The sign assembly shall be installed on the sign structure. The controller cabinet foundation shall be constructed as shown on the plans for Model 334 cabinets (including furnishing and installing anchor bolts), the controller cabinet shall be installed on the foundation, and the field wiring connections shall be made to the terminal blocks in the sign assembly and in the controller cabinet.

Field conductors No. 12 and smaller shall terminate with spade terminals. Field conductors No. 10 and larger shall terminate in spade or ring terminals.

A listing of field conductor terminations, in each State-furnished changeable message sign and controller cabinet, will be furnished free of charge to the Contractor at the site of the work.

The location of the foundation for each controller cabinet will be determined by the Engineer.

State forces will maintain the sign assemblies. The Contractor's responsibility shall be limited to conformance with the provisions in Section 6-1.02, "State-Furnished Materials," of the Standard Specifications.

10-3.23 FIBER OPTIC CABLE PLANT

Fiber optic cable shall conform to the details shown on the plans and these special provisions

DEFINITIONS

The following definitions shall apply to these special provisions:

- A. Active Component Link Loss Budget.—The active component link loss budget is the difference between the average transmitter launch power (in dBm) and the receiver maximum sensitivity (in dBm).
- B. Backbone.—Fiber cable that provides connections between the RTMC and hubs, as well as between equipment rooms or buildings, and between hubs. The term is used interchangeably with "trunk" cable.
- C. Connector.—A mechanical device used to align and join two fibers together to provide a means for attaching to and decoupling from a transmitter, receiver, or another fiber (patch panel).
- D. Connectorized.—The termination point of a fiber after connectors have been affixed.
- E. Connector Module Housing (CMH) .—A patch panel used to terminate singlemode fibers with most common connector types. It may include a jumper storage shelf and a hinged door.
- F. Couplers.—Devices which mate fiber optic connectors to facilitate the transition of optical light signals from one connector into another. They are normally located within FDU's, mounted in panels. They may also be used unmounted, to join two simplex fiber runs.
- G. Distribution Cable.—Fiber cable that provides connections between hubs. Drop cables are typically spliced into a distribution cable.
- H. Drop Cable.—Fiber cable that provides connections between a distribution cable to a field element. Typically these run from a splice vault to a splice tray within a field cabinet. Drop cables are usually short in length (less than 20m) and are of the same construction as outside plant cable. The term "breakout cable" is used interchangeably with drop cable.
- I. End-to-End Loss.—The maximum permissible end-to-end system attenuation is the total loss in a given link. This loss could be the actual measured loss, or calculated using typical (or specified) values. A designer should use typical values to calculate the end-to-end loss for a proposed link. This number will determine the amount of optical power (in dB) needed to meet the System Performance Margin.
- J. Fan Out Termination.—Permits the branching of fibers contained in an optical cable into individual cables and can be done at field locations; thus, allowing the cables to be connectorized or terminated per system requirements. A kit provides pull-out protection for individual bare fibers to support termination. It provides three layers of protection consisting of a Teflon inner tube, a dielectric strength member, and an outer protective PVC jacket. Fan out terminations shall not be used for more than 6 fibers. Using a patch panel would be appropriate.
- K. Fiber Distribution Frame (FDF) .—A rack mounted system that is usually installed in hubs or the Regional Transportation Management Center (RTMC), that may consist of a standard equipment rack, fiber routing guides, horizontal jumper troughs and Fiber Distribution Units (FDU). The FDF serves as the termination and interconnection of passive fiber optic components from cable breakout, for connection by jumpers, to the equipment.
- L. Fiber Distribution Unit (FDU) .—An enclosure or rack mountable unit containing both a patch panel with couplers and splice tray(s). The unit's patch panel and splice trays may be integrated or separated by a partition.
- M. F/O.—Fiber optic.
- N. FOIP.—Fiber optic inside plant cable.
- O. FOOP.—Fiber optic outside plant cable.
- P. FOTP.—Fiber optic test procedure(s) as defined by TIA/EIA standards.
- Q. Jumper.—A short cable, typically one meter or less, with connectors on each end, used to join two CMH couplers or a CMH to active electronic components.
- R. Light Source.—Portable fiber optic test equipment that, when coupled with a power meter, is used to perform end-to-end attenuation testing. It contains a stabilized light source operating at the wavelength of the system under test.
- S. Link.—A passive section of the system, the ends of which are connectorized. A link may include splices and couplers. For example, a video link may be from a F/O transmitter to a video multiplexer (MUX).

- T. Loose Tube Cable.—Type of cable construction in which fibers are placed in buffer tubes to isolate them from outside forces (stress). A flooding compound or material is applied to the interstitial cable core to prevent water migration and penetration. This type of cable is primarily for outdoor applications.
- U. Mid-span Access Method.—Description of a procedure in which fibers from a single buffer tube are accessed and spliced to an adjoining cable without cutting the unused fibers in the buffer tube, or disturbing the remaining buffer tubes in the cable.
- V. MMFO.—Multimode Fiber Optic Cable.
- W. Optical Time Domain Reflectometer (OTDR) .—Fiber optic test equipment similar in appearance to an oscilloscope that is used to measure the total amount of power loss in a F/O cable between two points. It provides a visual and printed display of the losses associated with system components such as fiber, splices and connectors.
- X. Optical Attenuator.—An optical element that reduces the intensity of a signal passing through it.
- Y. Patchcord.—A term used interchangeably with "jumper".
- Z. Patch Panel.—A precision drilled metal frame containing couplers used to mate two fiber optic connectors.
- AA. Pigtail.—A short optical fiber permanently attached to a source, detector, or other fiber optic device.
- AB. Power Meter.—Portable fiber optic test equipment that, when coupled with a light source, is used to perform end-to-end attenuation testing. It contains a detector that is sensitive to light at the designed wavelength of the system under test. Its display indicates the amount of optical power being received at the end of the link.
- AC. Riser Cable.—NEC approved cable installed in a riser (a vertical shaft in a building connecting floors).
- AD. Segment.—A section of F/O cable that is not connected to any active device and may or may not have splices per the design.
- AE. SMFO.—Singlemode Fiber Optic Cable.
- AF. Splice.—The permanent joining of two fiber ends using a fusion splicer.
- AG. Splice Closure.—A environmentally sealed container used to organize and protect splice trays. The container allows splitting or routing of fiber cables from multiple locations. Normally installed in a splice vault.
- AH. Splice Module Housing (SMH) .—A unit that stores splice trays as well as pigtails and short cable lengths. The unit allows splitting or routing of fiber cables to or from multiple locations.
- AI. Splice Tray.—A container used to organize and protect spliced fibers.
- AJ. Splice Vault.—An underground container used to house excess cable and/or splice closures.
- AK. System Performance Margin.—A calculation of the overall "End to End" permissible attenuation from the fiber optic transmitter (source) to the fiber optic receiver (detector). The system performance margin should be at least 6 dB. This includes the difference between the active component link loss budget, the passive cable attenuation (total fiber loss) and the total connector/splice loss.
- AL. Tight Buffered, Non-Breakout Cable (Tight Buffer Cable).—Type of cable construction where each glass fiber is tightly buffered (directly coated) with a protective thermoplastic coating to 900 µm (compared to 250 µm for loose tube fibers).

FIBER OPTIC OUTSIDE PLANT CABLE

General

Each fiber optic outside plant cable (FOOP) for this project shall be all dielectric, non gel filled or water-blocking material, duct type, with loose buffer tubes and shall conform to these special provisions. Cables with singlemode fibers shall contain 12 and 72 singlemode (SM) dual-window (1310 nm and 1550 nm) fibers. The optical fibers shall be contained within loose buffer tubes. The loose buffer tubes shall be stranded around an all dielectric central member. Aramid yarn and/or fiberglass shall be used as a primary strength member, and a polyethylene outside jacket shall provide for overall protection.

All fiber optic (F/O) cable on this project shall be from the same manufacturer, who is regularly engaged in the production of this material.

The cable shall be qualified as compliant with RUS Federal Rule 7CFR1755.900.

CABLE TYPE	DESCRIPTION
E	12SMFO
I	72SMFO

Fiber Characteristics

Each optical fiber shall be glass and consist of a doped silica core surrounded by concentric silica cladding. All fibers in the buffer tube shall be usable fibers, and shall be sufficiently free of surface imperfections and occlusions to meet the optical, mechanical, and environmental requirements of these specifications. The required fiber grade shall reflect the maximum individual fiber attenuation, to guarantee the required performance of each and every fiber in the cable.

The coating shall be a dual layered, UV cured acrylate. The coating shall be mechanically or chemically strippable without damaging the fiber.

The cable shall comply with the optical and mechanical requirements over an operating temperature range of -40°C to +70°C. The cable shall be tested in accordance with EIA-455-3A (FOTP-3), "Procedure to Measure Temperature Cycling Effects on Optical Fiber, Optical Cable, and Other Passive Fiber Optic Components." The change in attenuation at extreme operational temperatures (-40°C to +70°C) for singlemode fiber shall not be greater than 0.20 dB/km, with 80 percent of the measured values no greater than 0.10 dB/km.

Singlemode fibers within the finished cable shall meet the requirements in the following table:

Fiber Characteristics Table	
Parameters	Singlemode
Type	Step Index
Core diameter	8.3 μm (nominal)
Cladding diameter	125 μm ± 1.0 μm
Core to Cladding Offset	0.8 μm
Coating Diameter	250 μm ± 15 μm
Cladding Non-circularity defined as: [1-(min. cladding dia \div max. cladding dia.)] x 100	1.0%
Proof/Tensile Test	345 Mpa, min.
Attenuation: (-40(C to +70(C) @ 1310 nm @ 1550 nm	0.4 dB/km 0.3 dB/km
Attenuation at the Water Peak	2.1 dB/km @ 1383 ± 3 nm
Chromatic Dispersion: Zero Dispersion Wavelength Zero Dispersion Slope	1301.5 to 1321.5 nm 0.092 ps/(nm ² *km)
Maximum Dispersion:	3.3 ps/(nm*km) for 1285 – 1330 nm <18 ps/(nm*km) for 1550 nm
Cut-Off Wavelength	<1260 1250 nm
Mode Field Diameter (Petermann II)	9.3 ± 0.5 μm at 1300 1310 nm 10.5 ± 1.0 μm at 1550 nm

Color Coding

In buffer tubes containing multiple fibers, each fiber shall be distinguishable from others in the same tube by means of color coding according to the following:

- | | |
|----------------|-----------------|
| 1. Blue (BL) | 7. Red (RD) |
| 2. Orange (OR) | 8. Black (BK) |
| 3. Green (GR) | 9. Yellow (YL) |
| 4. Brown (BR) | 10. Violet (VL) |
| 5. Slate (SL) | 11. Rose (RS) |
| 6. White (WT) | 12. Aqua (AQ) |

Buffer tubes containing fibers shall also be color coded with distinct and recognizable colors according to the same table listed above for fibers.

These colors shall be targeted in accordance with the Munsell color shades and shall meet EIA/TIA-598 "Color Coding of Fiber Optic Cables."

The color formulation shall be compatible with the fiber coating and the buffer tube filling compound, and be heat stable. It shall not fade or smear or be susceptible to migration and it shall not affect the transmission characteristics of the optical fibers and shall not cause fibers to stick together.

Cable Construction

A. General: The fiber optic cable shall consist of, but not be limited to, the following components:

1. Buffer tubes
2. Central member
3. Filler rods
4. Stranding
5. Core and cable flooding
6. Tensile strength member
7. Ripcord
8. Outer jacket

1. Buffer Tubes

Clearance shall be provided in the loose buffer tubes between the fibers and the inside of the tube to allow for expansion without constraining the fiber. The fibers shall be loose or suspended within the tubes. The fibers shall not adhere to the inside of the buffer tube. Each buffer tube shall contain a maximum of 12 fibers.

The loose buffer tubes shall be extruded from a material having a coefficient of friction sufficiently low to allow free movement of the fibers. The material shall be tough and abrasion resistant to provide mechanical and environmental protection of the fibers, yet designed to permit safe intentional "scoring" and breakout, without damaging or degrading the internal fibers.

Buffer tube filling compound shall be a homogeneous hydrocarbon-based gel with anti-oxidant additives and used to prevent water intrusion and migration. The filling compound shall be non-toxic and dermatologically safe to exposed skin. It shall be chemically and mechanically compatible with all cable components, non-nutritive to fungus, non-hygroscopic and electrically non-conductive. The filling compound shall be free from dirt and foreign matter and shall be readily removable with conventional nontoxic solvents.

Buffer tubes shall be stranded around a central member by a method, such as the reverse oscillation stranding process, that will prevent stress on the fibers when the cable jacket is placed under strain.

2. Central Member

The central member which functions as an anti-buckling element shall be a glass reinforced plastic rod with similar expansion and contraction characteristics as the optical fibers and buffer tubes. To ensure the proper spacing between buffer tubes during stranding, a symmetrical linear overcoat of polyethylene may be applied to the central member to achieve the optimum diameter.

3. Filler Rods

Fillers may be included in the cable to maintain the symmetry of the cable cross-section. Filler rods shall be solid medium or high density polyethylene. The diameter of filler rods shall be the same as the outer diameter of the buffer tubes.

4.. Stranding

Completed buffer tubes shall be stranded around the overcoated central member using stranding methods, lay lengths and positioning such that the cable shall meet mechanical, environmental and performance specifications. A polyester binding shall be applied over the stranded buffer tubes to hold them in place. Binders shall be applied with sufficient tension to secure the buffer tubes to the central member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking (or rendered so by the flooding compound), and dielectric with low shrinkage.

5. Core and Cable Flooding

The cable core interstices shall contain a water blocking material, to prevent water ingress and migration. The water blocking material shall be either a polyolefin based compound which fills the cable core interstices, or an absorbent polymer, which fills voids and swells to block the ingress of water. The flooding compound or material shall be homogeneous, non-hygroscopic, electrically non-conductive, and non-nutritive to fungus. The compound or material shall also be nontoxic, dermatologically safe and compatible with all other cable components.

6. Tensile Strength Member

Tensile strength shall be provided by high tensile strength aramid yarns and/or fiberglass which shall be helically stranded evenly around the cable core and shall not adhere to other cable components.

7.. Ripcord

The cable shall contain at least one ripcord under the jacket for easy sheath removal.

8. Outer Jacket

The jacket shall be free of holes, splits, and blisters and shall be medium or high density polyethylene (PE), or medium density cross-linked polyethylene with minimum nominal jacket thickness of $1 \text{ mm} \pm 0.076 \text{ mm}$. Jacketing material shall be applied directly over the tensile strength members and water blocking material and shall not adhere to the aramid strength material. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus.

The jacket or sheath shall be marked with the manufacturer's name, the words "Optical Cable", the number of fibers, "SM", year of manufacture, and sequential measurement markings every meter. The actual length of the cable shall be within $-0/+1$ percent of the length marking. The marking shall be in a contrasting color to the cable jacket. The height of the marking shall be $2.5 \text{ mm} \pm 0.2 \text{ mm}$.

General Cable Performance Specifications

The F/O cable shall withstand water penetration when tested with a one meter static head or equivalent continuous pressure applied at one end of a one meter length of filled cable for one hour. No water shall leak through the open cable end. Testing shall be done in accordance with EIA-455-82 (FOTP-82), "Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable."

A representative sample of cable shall be tested in accordance with EIA/TIA-455-81 (FOTP-81), "Compound Flow (Drip) Test for Filled Fiber Optic Cable". No preconditioning period shall be conducted. The cable shall exhibit no flow (drip or leak) at 70 to 80°C as defined in the test method.

Crush resistance of the finished F/O cables shall be 220 N/mm applied uniformly over the length of the cable without showing evidence of cracking or splitting when tested in accordance with EIA-455-41 (FOTP-41), "Compressive Loading Resistance of Fiber Optic Cables". The average increase in attenuation for the fibers shall be 0.10 dB at 1550 nm (singlemode) for a cable subjected to this load. The cable shall not exhibit any measurable increase in attenuation after removal of load. Testing shall be in accordance with EIA-455-41 (FOTP-41), except that the load shall be applied at the rate of 3 mm to 20 mm per minute and maintained for 10 minutes.

The cable shall withstand 25 cycles of mechanical flexing at a rate of 30 ± 1 cycles/minute. The average increase in attenuation for the fibers shall be 0.20 dB at 1550 nm (singlemode) at the completion of the test. Outer cable jacket cracking or splitting observed under $10\times$ magnification shall constitute failure. The test shall be conducted in accordance with EIA-455-104 (FOTP-104), "Fiber Optic Cable Cyclic Flexing Test," with the sheave diameter a maximum of 20 times the outside diameter of the cable. The cable shall be tested in accordance with Test Conditions I and II of (FOTP-104).

The cable shall withstand 20 impact cycles, with a total impact energy of $5.9 \text{ N}\cdot\text{m}$. Impact testing shall be conducted in accordance with TIA/EIA-455-25B (FOTP-25) "Impact Testing of Fiber Optic Cables and Cable Assemblies." The average increase in attenuation for the fibers shall be $<0.20 \text{ dB}$ at 1550 nm for singlemode fiber. The cable shall not exhibit evidence of cracking or splitting.

The finished cable shall withstand a tensile load of 2700 N without exhibiting an average increase in attenuation of greater than 0.20 dB (singlemode). The test shall be conducted in accordance with EIA-455-33 (FOTP-33), "Fiber Optic Cable Tensile Loading and Bending Test." The load shall be applied for one-half hour in Test Condition II of the EIA-455-33 (FOTP-33) procedure.

Packaging and Shipping Requirements

Documentation of compliance to the required specifications shall be provided to the Engineer prior to ordering the material.

Attention is directed to "Fiber Optic Testing," elsewhere in these special provisions.

The completed cable shall be packaged for shipment on reels. The cable shall be wrapped in a weather and temperature resistant covering. Both ends of the cable shall be sealed to prevent the ingress of moisture.

Each end of the cable shall be securely fastened to the reel to prevent the cable from coming loose during transit. Four m of cable length on each end of the cable shall be accessible for testing.

Each cable reel shall have a durable weatherproof label or tag showing the manufacturer's name, the cable type, the actual length of cable on the reel, the Contractor's name, the contract number, and the reel number. A shipping record shall also be included in a weatherproof envelope showing the above information and also include the date of manufacture, cable characteristics (size, attenuation, bandwidth, etc.), factory test results, cable identification number and any other pertinent information.

The minimum hub diameter of the reel shall be at least thirty times the diameter of the cable. The F/O cable shall be in one continuous length per reel with no factory splices in the fiber. Each reel shall be marked to indicate the direction the reel should be rolled to prevent loosening of the cable.

Installation procedures and technical support information shall be furnished at the time of delivery.

LABELING

General

The Contractor shall label all fiber optic cabling in a permanent consistent manner. All tags shall be of a material designed for long term permanent labeling of fiber optic cables and shall be marked with permanent ink on non-metal types, or embossed lettering on metal tags. Metal tags shall be constructed of stainless steel. Non-metal label materials shall be approved by the Engineer. Labels shall be affixed to the cable per the manufacturer's recommendations and shall not be affixed in a manner which will cause damage to the fiber. Handwritten labels shall not be allowed.

Label Identification

1. Labeling of Cables

Labeling of the backbone, distribution and drop fiber optic cables shall conform to the following unique identification code elements:

UNIQUE IDENTIFICATION CODE ELEMENTS for Backbone, Distribution or Drop Cables		
DESCRIPTION	CODE	NUMBER OF CHARACTERS
District	District number	2
Cable Type	Fiber: S: Singlemode M: Multimode Copper: T: 18 AWG, U: 19 AWG, V: 20AWG, W: 22AWG X: 24 AWG	1
Cable fiber (or copper pairs) Count	Number of fibers or conductor pairs (Examples: 144 fibers; or 100 TWP)	3
Route Number	Hwy. Rte (Example: 005)	3
Begin Function	T: TMC or RTMC; H: HUB; V: Video Node; D: Data Node; C: Cable Node; M: CCTV Camera; N: CMS; P: Traffic Signal; Z: Ramp Meter; U: Traffic Monitoring/Count Station/Vehicle Count Station (VDS, TOS); S: Splice Vault	1
Begin Function Number	Unique ID number corresponds to Begin Function (Example: H02 [Hub 02])	2
End Function	T: TMC or RTMC; H: HUB; V: Video Node; D: Data Node; C: Cable Node; M: CCTV Camera; N: CMS; P: Traffic Signal; Z: Ramp Meter; U: Traffic Monitoring/Count Station; S: Splice Vault	1
End Function Number	Unique ID number corresponds to Begin Function (Example: H03 [Hub 03])	2
Unique Identifier	XX: If two or more cables of the same count are in the same run	2
TOTAL		17

Each cable shall display one unique identification, regardless of where the cable is viewed. The begin function and end function correspond to the end points of each cable. The order of the begin and end function follow a hierarchy as listed below, where the lowest number corresponding to the begin/end function is listed first.

List of Hierarchy										
1	2	3	4	5	6	7	8	9	10	11
TMC RTMC	HUB	Video Node (VN)	Data Node (DN)	Cable Node	CCTV Camera	CMS	Traffic Signal	Ramp Meter	Traffic Monitoring/ Count Station	Splice Vault

This scheme will work as follows: A cable between the TMC or RTMC and a HUB will always have the TMC or RTMC listed as the start function and the HUB as the end function. Between a CMS and a Splice Vault, the start function will always be listed as the CMS, and so on. If a cable is connected between HUBs, for example HUB-01 and HUB-03, the lowest number, in this case HUB-01, will be listed as the start function and HUB-03 as the end function.

A. Example 1: 08S060010H02H0302

This cable is located in District 8, identified as a singlemode fiber optic cable containing 60 fibers, installed along highway Route 10, beginning in Hub 2, and ending in Hub 3, with unique ID of number 2. The implication for the unique ID is that there may be another 60 fiber optic cable between those hubs. This is an example for a backbone cable.

B. Example 2: 11S048008H01S04

This cable is located in District 11, identified as a singlemode fiber optic cable containing 48 fibers, installed along highway Route 8, beginning in Hub 1, and ending in Splice Vault 04. In this case, no additional digits are necessary for a unique ID. This is an example for a distribution cable.

C. Example 3: 11S006163N03S04

This cable is located in District 11, identified as a singlemode fiber optic cable containing 6 fibers, installed along highway Route 163, beginning at CMS-03, and ending in Splice Vault 04. In this case, no additional digits are necessary for a unique ID. This is an example for a drop cable.

2. Labeling of Jumpers and Pigtails

Labeling of the jumpers and pigtails shall conform to the following unique identification code elements:

UNIQUE IDENTIFICATION CODE ELEMENTS for JUMPERS (active component to FDU) and PIGTAILS (to connector # on patch panel)		
DESCRIPTION	CODE	NUMBER OF CHARACTERS
Hub Identifier	Hub, TMC or RTMC, VN or DN ID Numbers or Alphanumeric or both	2
From (Source) Device	MU: Multiplexer FD: FDU (Fiber Distribution Unit) RP: Repeater	2
From (Source) Device Identifier	Numbers or Alphanumeric or both	2
Transmitter or Receiver	T or R	1
To (Destination) Device	MU: Multiplexer FD: FDU (Fiber Distribution Unit) RP: Repeater	2
To (Destination) Device Identifier	Numbers or Alphanumeric or both	2
Connector Identifier	Connector ID	2
TOTAL		13

A. Example 1: 01MU01TFD0203.

This pigtail is located in Hub 1, from multiplexer 01, transmitting to FDU 02 to patch panel position (connector) 03.

B. Example 2: 02MUA1TFD0B08.

This jumper is located in Hub 2, from multiplexer A1, transmitting to FDU B, to patch panel position (connector) 08.

Label Placement

1. Cables

All cables shall be clearly labeled with the unique identification code element method described elsewhere in these special provisions, at all terminations, even if no connections or splices are made, and at all splice vault entrance and exit points.

2. Cable to Cable Splices

All cable jackets entering the splice closure shall be labeled in accordance with the identification method described elsewhere in these special provisions.

3. Cable to Fiber Distribution Units

The cable jackets shall be clearly labeled at entry to the FDU in accordance with the unique identification code element method described elsewhere in these special provisions. In addition, each fiber shall be labeled with the Fiber ID and pigtails shall be labeled at the connector with the Fiber ID. The FDU shall be clearly labeled with the Cable ID on the face of the FDU. If multiple cables are connected to the FDU, each block of connectors relating to each individual cable shall be clearly identified by a single label with the Cable ID. Individual connections shall be clearly marked on the face of the FDU in the designated area with the Fiber ID.

4. Fiber

Fibers labels shall be placed next to the connectors of the individual fibers.

5. Patch Panels

The cable jackets shall be clearly labeled at entry to the Patch Panel in accordance with the unique identification code element method described elsewhere in these special provisions. In addition, each fiber shall be labeled with the Fiber ID and pigtails shall be labeled at the connector with the Fiber ID. The Patch panel shall be clearly labeled with the Cable ID on the face of the Panel. If multiple cables are connected to the Patch Panel, each block of connectors relating to each individual cable shall be clearly identified by a single label with the Cable ID. Individual connections shall be clearly marked on the face of the Panel in the designated area with the Fiber ID.

6. Jumpers

Equipment to FDU jumpers shall be labeled as to the equipment type connected and shall be labeled at both ends. FDU to FDU jumpers shall be labeled at each end in accordance with the unique identification code element method described elsewhere in these special provisions.

7. Pigtails

Pigtails shall be labeled at the connector in accordance with the unique identification code element method described elsewhere in these special provisions.

8. Copper Cable Labels

All twisted-pair communications cables shall be clearly labeled in a in accordance with the unique identification code element method described elsewhere in these special provisions.

CABLE INSTALLATION

Installation procedures shall be in conformance with the procedures specified by the cable manufacturer for the specific cable being installed. The contractor shall submit the manufacturer's recommended procedures for pulling fiber optic cable at least 20 working days prior to installing cable. Mechanical aids may be used provided that a tension measuring device, and a break away swivel are placed in tension to the end of the cable. The tension in the cable shall not exceed 2225 N or the manufacturer's recommended pulling tension, whichever is less.

During cable installation, the bend radius shall be maintained at a minimum of twenty times the outside diameter. The cable grips for installing the fiber optic cable shall have a ball bearing swivel to prevent the cable from twisting during installation.

F/O cable shall be installed using a cable pulling lubricant recommended by the F/O cable and/or the innerduct manufacturer, and a pull tape conforming to the provisions described under "conduit" elsewhere in these special provisions. Contractor's personnel shall be stationed at each splice vault and pullbox through which the cable is to be pulled to lubricate and prevent kinking or other damage.

F/O cable shall be installed without splices except where specifically allowed on the plans. If splice locations are not shown on the plans, splicing shall be limited to one cable splice every 6 km. Any midspan access splice or FDU termination shall involve only those fibers being spliced as shown on the plans. Cable splices shall be located in splice closures, installed in splice vaults shown on the plans. A minimum of 20 m of slack shall be provided for each F/O cable at each splice vault. Slack shall be divided equally on each side of the F/O splice closure.

Unless shown or provided otherwise, only F/O cable shall be installed in each innerduct. Pulling a separate F/O cable into a spare duct to replace damaged fiber will not be allowed.

At the Contractor's option, the fiber may be installed using the air blown method. If integral innerduct is used, the duct splice points or any temporary splices of innerduct used for installation must withstand a static air pressure of 758 kPa.

The fiber installation equipment must incorporate a mechanical drive unit or pusher, which feeds cable into the pressurized innerduct to provide a sufficient push force on the cable, which is coupled with the drag force created by the high-speed airflow. The unit must be equipped with controls to regulate the flow rate of compressed air entering the duct and any hydraulic or pneumatic pressure applied to the cable. It must accommodate longitudinally ribbed, or smooth wall ducts from nominal 16 mm to 51 mm inner diameter. Mid assist or cascading of equipment must be for the installation of long cable runs. The equipment must incorporate safety shutoff valves to disable the system in the event of sudden changes in pneumatic or hydraulic pressure.

The equipment must not require the use of a piston or any other air capturing device to impose a pulling force at the front end of the cable, which also significantly restricts the free flow of air through the inner duct. It must incorporate the use of a counting device to determine the speed of the cable during installation and the length of the cable installed.

SPLICING

Field splices shall be done either in splice vaults or cabinets as shown on the plans. All splices in splice vaults shall be done in splice trays, housed in splice closures. All splices in cabinets shall be done in splice trays housed in FDU's.

Unless otherwise specified, fiber splices shall be the fusion type. The mean splice loss shall not exceed 0.07 dB per splice. The mean splice loss shall be obtained by measuring the loss through the splice in both directions and then averaging the resultant values.

All splices shall be protected with a metal reinforced thermal shrink sleeve.

The mid-span access method shall be used to access the individual fibers in a cable for splicing to another cable as shown on the plans. Cable manufacturers recommended procedures and approved tools shall be used when performing a mid-span access. Only the fibers to be spliced may be cut. All measures shall be taken to avoid damaging buffer tubes and individual fibers not being used in the mid-span access.

The individual fibers shall be looped one full turn within the splice tray to avoid micro bending. A 45 mm minimum bend radius shall be maintained during installation and after final assembly in the optical fiber splice tray. Each bare fiber shall be individually restrained in a splice tray. The optical fibers in buffer tubes and the placement of the bare optical fibers in the splice tray shall be such that there is no discernable tensile force on the optical fiber.

The Contractor will be allowed to splice a total of 30 percent of all fibers to repair any damage done during mid-span access splicing without penalty. The Contractor will be assessed a fine of \$300.00 for each additional and unplanned splice. Any single fiber may not have more than 3 unplanned splices. If any fiber requires more than 3 unplanned splices, the entire length of F/O cable must be replaced at the Contractor's expense.

SPLICE CLOSURES

The F/O field splices shall be enclosed in splice closures which shall be complete with splice organizer trays, brackets, clips, cable ties, seals and sealant, as needed. The splice closure shall be suitable for a direct burial or pull box application. Manufacturer's installation instructions shall be supplied to the Engineer prior to the installation of any splice closures. Location of the splice closures shall be where a splice is required as shown on the plans, designated by the Engineer, or described in these special provisions.

The splice closure shall conform to the following specifications:

- A. Non-filled thermoplastic case
- B. Rodent proof, water proof, re-enterable and moisture proof
- C. Expandable from 2 cables per end to 8 cables per end by using adapter plates
- D. Cable entry ports shall accommodate 10 mm to 25 mm diameter cables
- E. Multiple grounding straps
- F. Accommodate up to 8 splice trays
- G. Suitable for "butt" or "through" cable entry configurations
- H. Place no stress on finished splices within the splice trays

The splice closure shall be bolted to the side wall of the splice vault.

The Contractor shall verify the quality of each splice prior to sealing the splice closure. The splice closure shall not be sealed until link testing is performed and is approved by the Engineer.

SPLICE TRAYS

Splice trays must accommodate a minimum of 12 fusion splices and must allow for a minimum bend radius of 45 mm. Individual fibers must be looped one full turn within the splice tray to allow for future splicing. No stress is to be applied on the fiber when it is located in its final position. Buffer tubes must be secured near the entrance of the splice tray to reduce the chance that an inadvertent tug on the pigtail will damage the fiber. The splice tray cover may be transparent.

Splice trays in the splice closure shall conform to the following:

- A. Accommodate up to 24 fusion splices
- B. Place no stress on completed within the tray
- C. Stackable with a snap-on hinge cover
- D. Buffer tubes securable with channel straps
- E. Must be able to accommodate a fusion splice with the addition of an alternative splice holder
- F. Must be labeled after splicing is completed.

Only one single splice tray may be secured by a bolt through the center of the tray in the fiber termination unit. Multiple trays must be securely held in place as per the manufacturer's recommendation.

PASSIVE CABLE ASSEMBLIES AND COMPONENTS

The F/O cable assemblies and components shall be compatible components, designed for the purpose intended, and manufactured by a company regularly engaged in the production of material for the fiber optic industry. All components or assemblies shall be best quality, non-corroding, with a design life of at least 20 years.

The cable assemblies and components manufacturer shall be ISO9001 registered.

FIBER OPTIC CABLE TERMINATIONS

General

. The cable shall continue within the conduit to the designated termination point for cable termination. All components shall be the size and type required for the specified fiber. Fiber optic cable terminations may take place in several locations such as RTMCs, data nodes, cable nodes, TOS cabinets, camera sites, etc.

Cable Termination

At the FDU, the cable jacket of the FOIP or outside plant cable, shall be removed exposing the aramid yarn, filler rods, and buffer tubes. The exposed length of the buffer tubes shall be at least the length recommended by the FDU manufacturer which allows the tubes to be secured to the splice trays. Each buffer tube shall be secured to the splice tray in which it is to be spliced. The remainder of the tubes shall be removed to expose sufficient length of the fibers in order to properly install on the splice tray, as described in "Splicing," elsewhere in these special provisions

The cable shall then be spliced and secured with tie wraps and routed to its appropriate fiber distribution frame/unit (FDF/U) as shown on the plans.

When applicable, moisture blocking gel shall be removed from the exposed buffer tubes and fibers. The transition from the buffer tube to the bundle of jacketed fibers shall be treated by an accepted procedure for sleeve tubing, shrink tube and silicone blocking of the transition to prevent future gel leak. Manufacturer directions shall be followed to ensure that throughout the specified temperature range gel will not flow from the end of the buffer tube. The individual fibers shall be stripped and prepared for splicing.

Factory terminated pigtails shall then be spliced and placed in the splice tray.

All fibers inside a fiber optic cable entering an Fiber Distribution Unit (FDU), such as at a TMC or RTMC or hub, shall be terminated and labeled. Attention is directed to "Fiber Distribution Unit" elsewhere in these special provisions.

A transition shall then be made, with flexible tubing, to isolate each fiber to protect the individual coated fibers. The final transition from bundle to individual fiber tube shall be secured with an adhesive heat shrink sleeve. Refer to Fan Out Termination, elsewhere in these special provisions.

Distribution Interconnect Package

Distribution involves connecting the fibers to locations shown on the plans. The distribution interconnect package consists of FDFs and FDU's with connector panels, couplers, splice trays, fiber optic pigtails and cable assemblies with connectors. The distribution interconnect package shall be assembled and tested by a company that is regularly engaged in the assembly of these packages. Attention is directed to "Fiber Optic Testing" elsewhere in these special provisions. All distribution components shall be products of the same manufacturers, who are regularly engaged in the production of these components, and the respective manufacturers shall have quality assurance programs.

Fiber Optic Cable Assemblies and Pigtails

1. General

Cable assemblies (jumpers and pigtails) shall be products of the same manufacturer. The cable used for cable assemblies shall be made of fiber meeting the performance requirements of these special provisions for the F/O cable being connected.

2. Pigtails

Pigtails shall be of simplex (one fiber) construction, in 900 μ m tight buffer form, surrounded by aramid for strength, with a PVC jacket with manufacturer identification information, and a nominal outer jacket diameter of 3 mm. Singlemode simplex cable jackets shall be yellow in color. All pigtails shall be factory terminated and tested and at least one meter in length.

3. Jumpers

Jumpers may be of simplex or duplex design. Duplex jumpers shall be of duplex round cable construction, and shall not have zipcord (siamese) construction. All jumpers shall be at least 2 m in length, sufficient to avoid stress and allow orderly routing.

The outer jacket of duplex jumpers shall be colored according to the singlemode color (yellow) specified above. The two inner simplex jackets shall be contrasting colors to provide easy visual identification for polarity.

4. Connectors

Connectors shall be of the ceramic ferrule ST type for SM. Indoor ST connector body housings shall be either nickel plated zinc or glass reinforced polymer construction. Outdoor ST connector body housing shall be glass reinforced polymer.

The associated coupler shall be of the same material as the connector housing.

All F/O connectors shall be the 2.5 mM connector ferrule type with Zirconia Ceramic material with a PC (Physical Contact) pre-radiused tip.

The ST connector operating temperature range shall be -40°C to +70°C. Insertion loss shall not exceed 0.4 dB for singlemode, and the return reflection loss on singlemode connectors shall be at least -35 dB. Connection durability shall be less than a 0.2 dB change per 500 mating cycles per EIA-455-21A (FOTP-21). All terminations shall provide a minimum 222 N pull out strength. Factory test results shall be documented and submitted to the Engineer prior to installing any of the connectors. Singlemode connectors shall have a yellow color on the body and/or boot that renders them easily identifiable.

Field terminations shall be limited to splicing of adjoining cable ends and/or cables to ST pigtails.

All connectors shall be factory-installed and tested. There shall be no installation of connectors in the field.

All unmated connectors shall have protective caps installed.

FIBER DISTRIBUTION UNIT

The fiber distribution unit (FDU) shall consist of a EIA 482 mm rack, a compartment for termination and distribution cable tray and a compartment for a splice drawer.

The FDU shall not exceed 250 mm in height and 380 mm in depth

The Contractor shall furnish and install all components to terminate the incoming fiber optic communication cables:

FDU Type	Accommodates Termination of
B	12 SMFO fibers
D	72 SMFO fibers

The fiber distribution unit shall include a patch panel to terminate the appropriate number of singlemode fibers with ST type connector feed through couplers.

The termination and distribution cable trays shall accommodate 12 and 72 singlemode optical fiber cables. The termination and distribution cable trays shall have sufficient tray areas for excess optical fiber storage with provisions to assure that the optical fibers do not exceed a 51 mm bend radius. The termination and distribution cable trays shall include a designation strip for identification of the 12 and 72 singlemode optical fibers. Each splice drawer shall include two splice trays with each splice tray capable of accommodating 12 and 72 fusion type splices. Each splice drawer shall allow for storage of excess lengths of the optical fibers of fiber optic cables. Each fiber distribution unit shall be provided with cable clA to secure fiber optic cables to the chassis.

Strain relief shall be provided for the incoming fiber optic cable. Cable accesses shall have rubber grommets or similar material to prevent the cable from coming in contact with bare metal. All fibers shall be terminated and individually identified in the FDU and on the patch panel.

The patch panel shall be hinged or have coupler plates to provide easy access and maintenance. Brackets shall be provided to spool the incoming fiber a minimum of two turns, each turn shall not be less than 300 mm, before separating out individual fibers to the splice tray.

Installation.--The Contractor shall install sufficient quantity of fiber distribution units to terminate all fibers in the largest cable as shown in the Plans. The fiber distribution shall be mounted in equipment racks as shown on the plans. At each fiber distribution unit, the Contractor shall terminate the optical fibers of the fiber optic cable. The optical fibers shall be fusion spliced to each of the single mode optical fiber cables assemblies within the splice tray(s).

The optical fibers shall be of appropriate lengths to allow for future splicing with the splice drawer and shall be appropriately identified (tagged). All splices shall be fusion type and shall be arranged within the splice trays of the fiber distribution unit in accordance with the organizational design of the splice trays. Appropriate protective coating shall be applied to all fusion splices.

Payment.--Full compensation for fiber distribution unit shall be considered as included in the contract prices paid for the various item of work requiring fiber distribution unit and no separate payment will be made therefor.

Fan Out Termination

A fan out termination shall be required as shown on the plans designated by the Engineer or described in these special provisions.

For fiber counts of less than 6 fibers, a fan out termination may be used to terminate the incoming fiber optic cable. The connector return loss shall be no greater than -40 dB.

The fan out termination shall consist of a splice connector and the appropriate number of fiber optic pigtails which will be fusion spliced to the incoming fibers.

The pigtail shall be contained in a housing that will provide strain relief between the incoming fiber optic cable plant jacket, buffer tubes, fibers and pigtail jacket material.

Each fiber shall be spliced to a pigtail with a factory installed and polished ST connector, as specified elsewhere in these special provisions. The splices shall then be encapsulated in a weatherproof housing. Each connector shall have a weatherproof cap to protect it from the elements. The pigtail shall be of simplex (one fiber) construction, in a 900 µm tight buffer form, surrounded by Aramid yarn for strength. The buffer shall have a PVC jacket with manufacturer identification information, and a nominal outer jacket diameter of 3 mm. Singlemode simplex cable jackets shall be yellow in color. All pigtails shall be at least two meter in length.

Each pigtail shall be labeled, as specified elsewhere in these special provisions, and secured onto the cable using clear heat shrink tubing.

FIBER OPTIC TESTING

General

Testing shall include the tests on elements of the passive fiber optic components: (1) at the factory, (2) after delivery to the project site but prior to installation, (3) after installation but prior to connection to any other portion of the system. The Contractor shall provide all personnel, equipment, instrumentation and materials necessary to perform all testing. The Engineer shall be notified two working days prior to all field tests. The notification shall include the exact location or portion of the system to be tested.

Documentation of all test results shall be provided to the Engineer within 2 working days after the test involved.

A minimum of 15 working days prior to arrival of the cable at the site, the Contractor shall provide detailed test procedures for all field testing for the Engineer's review and approval. The procedures shall include the tests involved and

how the tests are to be conducted. Included in the test procedures shall be the model, manufacturer, configuration, calibration and alignment procedures for all proposed test equipment.

Factory Testing

Documentation of compliance with the fiber specifications as listed in the Fiber Characteristics Table shall be supplied by the original equipment manufacturer. Before shipment, but while on the shipping reel, 100 percent of all fibers shall be tested for attenuation. Copies of the results shall be (1) maintained on file by the manufacturer with a file identification number for a minimum of seven years, (2) attached to the cable reel in a waterproof pouch, and (3) submitted to the Contractor and to the Engineer.

Arrival On Site

The cable and reel shall be physically inspected on delivery and 100 percent of the fibers shall be attenuation tested to confirm that the cable meets requirements. The failure of any single fiber in the cable to comply with these special provisions, is cause for rejection of the entire reel. Test results shall be recorded, dated, compared and filed with the copy accompanying the shipping reel in a weather proof envelope. Attenuation deviations from the shipping records of greater than five percent shall be brought to the attention of the Engineer. The cable shall not be installed until completion of this test sequence and the Engineer provides written approval. Copies of traces and test results shall be submitted to the Engineer. If the test results are unsatisfactory, the reel of F/O cable shall be considered unacceptable and all records corresponding to that reel of cable shall be marked accordingly. The unsatisfactory reels of cable shall be replaced with new reels of cable at the Contractor's expense. The new reels of cable shall then be tested to demonstrate acceptability. Copies of the test results shall be submitted to the Engineer.

After Cable Installation

Index matching gel shall not be allowed in connectors during testing. After the fiber optic cable has been pulled but before breakout and termination, 100 percent of all the fibers shall be tested with an OTDR for attenuation. Test results shall be recorded, dated, compared and filed with the previous copies of these tests. Copies of traces and test results shall be submitted to the Engineer. If the OTDR test results are unsatisfactory, the F/O cable segment of cable shall be unacceptable. The unsatisfactory segment of cable shall be replaced with a new segment, without additional splices, at the Contractor's expense. The new segment of cable then shall be tested to demonstrate acceptability. Copies of the test results shall be submitted to the Engineer.

System Cable Verification At Completion

1. Power Meter and Light Source

At the conclusion of the OTDR testing, 100 percent of the fiber links shall be tested end to end with a power meter and light source, in accordance with EIA Optical Test Procedure 171 and in the same wavelengths specified for the OTDR tests. These tests shall be conducted in one direction. As shown in Appendix A, the Insertion Loss (IC) shall be calculated. Test results shall be recorded, compared, and filed with the other recordings of the same links. Test results shall be submitted to the Engineer. These values shall be recorded in the Cable Verification Worksheet in Appendix A.

2. OTDR Testing

Once the passive cabling system has been installed and is ready for activation, 100 percent of the fibers shall be tested with the OTDR for attenuation at wavelengths of both 1310 nm and 1550 nm. OTDR testing shall be performed in both directions (bidirectional), on all fibers. Test results shall be generated from software of the test equipment, recorded, dated, compared and filed with previous copies. A hard copy printout and a electronic copy on a DOS based 89 mm diskette of traces and test results shall be submitted to the Engineer. The average of the two losses shall be calculated, and recorded in the Cable Verification Worksheet in Appendix A. The OTDR shall be capable of recording and displaying anomalies of at least 0.02 dB. All connector losses must be displayed on the OTDR traces.

3. Cable Verification Worksheet

The Cable Verification Worksheet shown in Appendix A shall be completed for all links in the fiber optic system, using the data gathered during cable verification. The completed worksheets shall be included as part of the system documentation.

4. Test Failures

If the link loss measured from the power meter and light source exceeds the calculated link loss, or the actual location of the fiber ends does not agree with the expected location of the fiber ends (as would occur with a broken fiber), the fiber optic link will not be accepted. The unsatisfactory segments of cable, or splices shall be replaced with a new segment of cable or splice at the Contractor's expense. The OTDR testing, power meter and light source testing and Cable Verification Worksheet shall be completed for the repaired link to determine acceptability. Copies of the test results shall be submitted to the Engineer. The removal and replacement of a segment of cable shall be interpreted as the removal and replacement of a single contiguous length of cable connecting two splices and two connectors. The removal of a small section containing the failure and therefore introducing new unplanned splices, will not be allowed.

Passive Component Package Testing and Documentation

All components in the passive component package (FDUs, pigtails, jumpers, couplers, and splice trays) shall be from a manufacturer who is ISO9001 registered.

In developing the passive component package, each connector termination (pigtail, or jumper) shall be tested for insertion attenuation loss using an optical power meter and source. In addition, all singlemode terminations shall be tested for return reflection loss. These values shall meet the loss requirements specified earlier and shall be recorded on a tag attached to the pigtail or jumper.

Once an assembly is complete, the manufacturer shall visually verify all tagging of loss values is complete. As a final quality control measure, the manufacturer shall do an "end to end" optical power meter/light source test from pigtail end to end to the terminating point assure continuity and overall attenuation loss valued.

The final test results shall be recorded, along with previous individual component values, on a special form assigned to each FDU. The completed form shall be dated and signed by the Manufacturer's Quality Control supervisor. One copy of this form will be attached in a plastic envelope to the assembled FDU unit. Copies will be provided separately to the Contractor and to the Engineer, and shall also be maintained on file by the manufacturer or supplier.

The assembled and completed FDU unit shall then be protectively packaged for shipment to the Contractor for installation.

Fiber Optic System Performance Margin Design Criteria

The installed system performance margin shall be at least 6 dB for every link. If the design system performance margin is less than 6 dB, the Engineer shall be notified and informed of the Contractor's plan to meet that requirement.

Active Component Testing

The transmitters and receivers shall be tested with a power meter and light source, to record the transmitter average output power (dBm) and receiver sensitivity (dBm). These values shall be recorded in the Fiber System Performance Margin Calculations Worksheet in Appendix B, section C, number 6.

APPENDIX A

Cable Verification Worksheet *End-to-End Attenuation (Power Meter and Light Source) Testing and OTDR Testing*

Contract No. _____ Contractor: _____

Operator: _____ Date: _____

Link Number: _____ Fiber Number: _____

Test Wavelength (Circle one): 1310 nm 1550 nm

Expected Location of fiber ends: End 1: _____ End 2: _____

Power Meter and Light Source Test Results:

Power In:	_____ dBm	1A
Output Power:	_____ dBm	1B
Insertion Loss [1A - 1B]:	_____ dB	1C

OTDR Test Results:

Forward Loss:	_____ dB	2A
Reverse Loss:	_____ dB	2B
Average Loss [(2A + 2B)/2]:	_____ dB	2C

To Be Completed by Caltrans:

Resident Engineer's Signature: _____

Cable Link Accepted: _____

APPENDIX B
Fiber System Performance Margin Calculations Worksheet

A. Calculate the Passive Cable Attenuation

1. Calculate Fiber Loss at Operating Wavelength: _____ nm	Cable Distance (times) Individual Fiber Loss (equal) @ 1310 nm (0.4 dB/km) @ 1550 nm (0.3 dB/km)	_____ km x _____ dB/km =
Total Fiber Loss:		_____ dB

B. Calculate the Total Connector/Splice Loss

2. Calculate Connectors/couplers Loss: (exclude Tx and Rx connectors)	Individual Connector Loss (times) Number of Connector Pairs (equal) Total Connector Loss:	0.4 dB x _____ = _____ dB
3. Calculate Splice Loss:	Individual Splice Loss (times) Number of Splices (equal) Total Splice Loss:	0.1 dB x _____ = _____ dB
4. Calculate Other Components Loss:	Total Components:	_____ dB
5. Calculate Total Losses:	Total Connector Loss (plus) Total Splice Loss (plus) Total Components (equal)	+ _____ dB + _____ dB + _____ dB =
Total Connector/Splice Loss:		_____ dB

C. Calculate Active Component Link Loss Budget

System Wavelength:		_____ nm
Fiber Type:		singlemode
Average Transmitter Output (Launch Power):		_____ dBm
Receiver MAX Sensitivity (10 ⁹ BER) (minus)		_____ dBm
Receiver MIN Sensitivity (equal)		- _____ dBm =
Receiver Dynamic Range:		_____ dB
6. Calculate Active Component Link Loss Budget:	Average Transmitter Output (Launch Power) (minus)	_____ dBm
	Receiver MAX Sensitivity (equal)	- _____ dBm =
Active Component Link Loss Budget:		_____ dB

D. Verify Performance

7. Calculate System Performance Margin to Verify Adequate Power:	Active Component Link Loss Budget [C] (minus) Passive Cable Attenuation [A] (minus) Total Connector/Splice Lost [B] (equal)	_____ dB - _____ dB - _____ dB =
System Performance Margin:		_____ dB

10-3.24 CLOSED CIRCUIT TELEVISION EQUIPMENT

GENERAL

Closed circuit television equipment shall conform to all rules and regulations of the Federal Communications Commission (FCC) and shall conform to the provisions in Section 86, "Signals, Lighting and Electrical Systems," of the Standard Specifications and these special provisions.

Prototype equipment is not acceptable. All equipment shall be current standard production units and shall have been in production for a minimum of six months. Rebuilt or reconditioned equipment will not be allowed.

All rack mounted equipment and card cage assemblies shall have metal filler plates to cover any unused channel slots or card slots.

The Contractor shall arrange to have a technician, qualified to work on the closed circuit television equipment and employed by the closed circuit television equipment manufacturer or his representative, present at the time the equipment is turned on.

CLOSED CIRCUIT TELEVISION CAMERA LOCATION

Closed circuit television (CCTV) camera at various locations shall consist of providing electrical service and installing Type 334-TV cabinet, CCTV camera assembly which includes pan and tilt unit, digital signal processing (DSP) color video camera, camera lens and camera housing, camera control receiver (CCR) and camera control circuits and accessories, CCTV wirings which include enclosed cables for video and camera control, connectors and coaxial cables, camera pole, camera junction box, single fiber optic video transceiver (transmitter), sign truss mounts where required and other required equipment, as shown on plans and as directed by the Engineer, to provide a fully functional site at locations as shown on the plans.

CCTV locations that coincide with video nodes may omit the single fiber optic video transceiver in the video node by routing the video coaxial cables to the video multiplexer in the video node as shown on the plans.

The Closed circuit television (CCTV) Type 334-TV cabinet and control equipment shall consist of a Type 334-TV cabinet, single fiber optic video transceiver, camera control receiver as described elsewhere in these special provisions and plans.

Before installation, the Contractor shall test to verify that all equipment functions in accordance with manufacturer's specifications. After installation, all CCTV camera location equipment shall be tested at each individual site as described elsewhere in these special provisions.

CLOSED CIRCUIT TELEVISION CAMERA POLE

Camera poles shall conform to the provisions in Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications and these special provisions.

The CCTV camera pole shall be made from sheet steel, shall have a minimum yield of 331 MPa and shall be hot-dip galvanized after fabrication in accordance with the provisions in Section 75-1.05, "Galvanizing," of the Standard Specifications. The pole shall be fabricated to the dimensions and with all the accessories as shown in the plans.

The horizontal plane of the pan and tilt base plate shall be perpendicular to the vertical plane of the CCTV camera pole. The CCTV camera pole shall be erected plumb. The vertical axis of the erected CCTV camera pole shall be within 76 mm of the theoretical vertical axis when measured without the action of sunlight or wind.

A junction box of a type and configuration set forth elsewhere in the plans and these special provisions shall be typically installed on the camera pole, or the truss mounted pole, approximately 150 mm from the top of the pole as shown on the plans and described elsewhere in these special provisions.

CAMERA JUNCTION BOXES

The camera junction box shall be a NEMA 3R type, mounted on the camera poles where shown in the plans. The nominal dimensions of the camera junction box shall be 460 mm (H) x 355 mm (W) x 230 mm (D).

The camera junction boxes shall be securely mounted on the camera support structure using stainless steel straps. The mounting hardware or method shall not impede the operation of the door. The connections shall be weather tight grommets. The camera junction box shall be mounted on the side of the pole away from freeway traffic.

SIGN TRUSS MOUNT

The Contractor shall provide camera pole and camera mounts on existing sign trusses as shown on the plans.

The Contractor shall field verify all dimensions and shall provide shop drawings to the Engineer for approval prior to fabrication. The camera pole and camera mount shall be mechanically connected to the truss structure as shown on the plans. No field welding will be permitted. The mount shall have drilled holes provided to mount the pole or manual adjust head as shown on the plans.

The camera/housing assembly shall be mounted at the proper elevation and shall be set at the proper vertical and horizontal angles to provide a clear and unobstructed view of the freeway.

All mounting plates and brackets shall be fabricated from ASTM Designation: A36 steel plate and shall be hot-dip galvanized after fabrication. Steel plate, hardware and galvanizing shall be in accordance with the requirements of Section 75, "Miscellaneous Metal", of the Standard Specifications.

The truss mount shall be capable of supporting a camera/housing load of 91kgs.

CAMERA CONTROL RECEIVER

The camera control receiver (CCR) shall include all auxiliary equipment required to interface with the communication sub-system, outdoor pan and tilt units, and the CCTV camera assemblies.

Functional Description.--The camera control receiver shall receive commands from the existing camera control transmitter (CCT) in the RTMC and decode them within the switch closure, that is used to operate and orient a CCTV camera. In addition, the camera control receiver shall generate outputs to control ancillary equipment and operations as defined elsewhere in these special provisions. The CCR shall be connected to the single video fiber optic transceiver (transmit) by cable. The CCR shall be fully compatible with the existing Javelin Model JO1400R camera control transmitter and Javelin Model JO4100DT camera control keypad located in the RTMC and shall be completely interchangeable with COHU Series ER3490 and shall be compatible with a COHU ER3490K cable, or equal and as approved by the Engineer.

Functional Requirements.--The command messages addressed to the CCR shall cause an immediate response. In response to command messages, the state of the control relays shall be engaged for a specific period of time and returned automatically to a neutral state. If the action is to continue, an additional command from the single fiber optic video transceiver (transmit) shall be required. This shall provide a fail-safe mode of operation should communications be interrupted between the CCR and the existing CCT in the RTMC.

The specific length of time that any command remains latched shall be determined by the operational impact of that command, system and component requirements. Commands for camera movement and adjustment, such as, pan, tilt, iris and lens control shall use shorter latching times on the order of milliseconds, compared to external contact closures that shall latch for periods of seconds to minutes. The manufacturer shall provide documented evidence that the chosen time intervals for the latched commands do not negatively affect the operation of the camera, lens or the pan and tilt unit.

One set of dry contacts shall be permanently latched until a second command is received by the CCR. This function will be used to turn on communications equipment at selected sites. This communications equipment will remain operational until disengaged by the operator.

The CCR shall provide an EIA-RS232 compatible interface. In addition, it shall be possible to communicate with the CCR by way of the EIA-232-D interface and exercise all CCR functions.

The CCR shall be designed for continuous operation in outdoor weather conditions when installed in Type 334-TV, or equivalent, cabinets.

The CCR communication protocol shall be fully compatible with the existing CCT communication protocol and shall provide signaling rate 9600 bps to communicate with the existing CCT in the RTMC. Contractor shall configure the transmission rate of the equipment to 9600 bps.

A unique address shall be used to identify and accept commands sent from the camera control transmitter. This unique address shall be included in all signals sent from the CCR to the CCT.

Parity checks on each byte and any additional cyclic redundancy codes (CRC) or checksums required to ensure that random or fortuitous noise is not interpreted by the CCR as a valid message from the existing CCT in the RTMC.

Transmissions to the existing CCT in the RTMC only in response to a valid poll or command message which contains a unique address for the CCR.

Transmissions to different CCRs to share a single communication channel without interference or erroneous operation.

Acknowledgment of all correct messages.

Unique commands to exercise all functions of the CCR.

The Contractor shall provide the Engineer with detailed descriptions of the CCR communication protocol and interface specifications and license agreement to develop devices to interface with the existing CCT.

The CCR shall provide the following functions:

The CCR shall receive and decode signals from the existing CCT in the TMC or RTMC and activate pan, tilt, zoom, focus, iris and auxiliary functions at the remote camera site in the camera and pan, tilt and zoom unit. The CCR shall provide both local automatic and remote manual iris adjustment and shall provide control for automatic or manual shutter speed with the selections made by commands initiated from the existing CCT in the RTMC.

The CCR shall provide the capability to locally store and activate a minimum of 15 camera preset positions. The preset information shall be digitally stored at the CCR. Presets shall be assignable and activated from the existing CCT in the RTMC. In the event of a power failure preset settings shall be maintained. The CCR or CCT shall be able to re-calculate the preset values should the pan/tilt unit be replaced.

The CCR shall provide the capability of transmitting positioning feedback information from the pan, tilt, and zoom position to the existing CCT in the RTMC using an eight bit, or equivalent, digital format. The positioning feedback information shall only be transmitted when a command requesting positioning feedback is received from the existing CCT in the RTMC.

The CCR shall include the capability to process and implement a minimum of three auxiliary control signals. For example, auxiliary control signals may provide needed control of heaters, washers and wipers on cameras, etc. At least two of the auxiliary control signals shall be latching. At least three inputs capable of sensing a dry contact closure shall also be provided.

The CCR shall provide local control functions for pan, tilt, zoom, focus, and other operations. These control functions shall be performed from a portable unit communicating through a serial port on the CCR. A switch shall be provided to defeat remote commands from the existing CCT in the RTMC and allow the activation of all local control functions.

The failure of a single CCR unit or its associated modem shall not cause any other units to become inoperative or damage to its associated camera.

If communications to the CCR are interrupted, the CCR shall cause the camera to remain in the current position or move it to a preset position.

Operational Requirements.--The Contractor shall provide a certification from the original equipment manufacturer that the CCR will interface and operate over a standard telephone company voice grade line as required by these specifications when it is correctly connected to existing pan and tilt units and zoom lenses. In addition, the CCR shall meet the following requirements:

Electrical.--The CCR shall operate from a 120 VAC ± 10 percent, at 60 Hz ± 5 percent, power source and incorporate an internal, regulated power supply. The maximum power consumption shall be 45 W. Protection from power brown outs, current surges or voltage spikes of up to 1000 V shall be provided. The lens driver circuit shall provide power at the appropriate voltage for zoom, focus and iris controls, listed elsewhere in these special provisions. The pan and tilt driver circuit shall provide power at the appropriate voltages to control the movement of the pan and tilt unit.

Physical.--The CCR shall be supplied in a durable enclosure suitable for mounting in an EIA 482 mm rack . The maximum dimensions of the CCR shall be 203 mm x 482 mm W x 355 mm D.

The CCR shall be fully operational over an ambient temperature range of 23°C to 50°C. with relative humidity 5 to 90 percent. The CCR enclosure shall have all necessary bulkhead connectors for access to all required external cables.

Functional Testing of CCR.--The Contractor shall perform a functional test to verify that the CCR to be placed in the cabinet works in accordance with these specifications before installing the CCR. The CCR shall be installed as shown on the plans. The Contractor shall confirm equipment placement with the Engineer before installing any equipment.

The Contractor shall test the camera control system for the following functions:

After installing all equipment at each CCTV site, the Contractor shall confirm the operation of the camera control receiver using test equipment and other necessary equipment that emulates all the functions of the existing CCT in the RTMC, and shall document all results.

After installing all camera control receivers and the communication system, the Contractor shall demonstrate the operation of the camera control system and shall assign all system parameters using test equipment that emulates all the functions of the camera control keypad, camera control transmitter from the RTMC and shall keep test equipment in operation until witnessed and approved by the Engineer. Test equipment that emulates all the functions of the camera control transmitter shall address all camera control receivers (CCR) and shall operate all remote control functions, including pan and tilt, zoom, focus, set up, and shall recall a minimum of ten preset positions per remote CCR address. The response to the test equipment signals shall appear to be immediate.

CLOSED CIRCUIT TELEVISION WIRING

The CCTV wiring shall be installed between the camera assembly, pan and tilt unit and the camera control receiver, and shall consist of enclosed cables. The CCTV wiring shall be compatible with the camera assembly, pan and tilt unit and the camera control receiver.

CCTV wiring and connectors shall be configured to make the CCTV sub-system completely operational.

A bonding wire shall be provided between the junction box and the Type 334-TV cabinet.

All cables shall be:

- Installed without damaging the conductors or insulation.
- Installed without kinks.
- Handled in accordance with manufacturers specifications and recommended bending radius.
- Run continuously between terminations without splices.
- Installed with sufficient slack for equipment movement.
- Neatly tagged at both terminations to indicate source, destination and function.

All cables, cable assemblies and connectors shall meet all National Electrical Code standards with regards to voltage, current and environmental ratings. Specifications of all cables, cable assemblies, and connectors with strain relief backshells intended for use by the Contractor shall be submitted to the Engineer as part of the shop drawings for review and approval. The Contractor shall test the cables for continuity prior to and after installation. Cables shall be installed as shown on the plan sheet "CCTV Electrical Diagram for CCTV and Pan and Tilt."

ENCLOSED CAMERA CONTROL CABLES

The enclosed camera control cables shall connect the camera junction box to the camera control receiver located in the Type 334-TV cabinet and shall be compatible with a COHU ER3490K cable, or equal as shown on the plan sheet "CCTV Electrical Diagram for CCTV and Pan and Tilt." and as approved by the Engineer.

Each conductor in the cables shall be insulated with a polypropylene jacket, color coded for positive identification, have a resistance of 23.4 Ω /km at 20°C or less and be stranded.

Each conductor pair, in the twisted pair cables, shall be shielded with an aluminum-polyester tape wrap with a copper drain wire.

Each cable shall have an overall PVC jacket of no less than 1.14 mm thickness.

The RG-59U coaxial cable shall be compatible to Comm/Scope No. F59SSEF, Alpha 9006A, Manhattan M4204, or equal, and as approved by the Engineer

TYPE 334-TV CABINETS

The Type 334-TV cabinets shall include a Model 170-based cabinet, power distribution assembly, thermostatically controlled fan, door locks, EIA standard 482 mm equipment racks, all necessary mounting hardware and wiring, foundation and anchor bolts and other equipment as shown on the plans and specified in these special provisions. The Model 170 based cabinet is specified elsewhere in these special provisions.

The Contractor shall install a power distribution assembly at the bottom of the 482 mm equipment rack, inside the Type 334-TV cabinet in accordance with the plans. The power distribution assembly shall consist of the following: one 30 A, 120 or 240 V minimum, single pole main breaker; three 15 A, 120 V minimum, single pole secondary breakers; eight standard duplex 117 VAC receptacles; and one duplex, three prong, NEMA Type 5-15R grounded utility type outlet with ground fault interrupter. The power distribution assembly shall protect the electronic equipment powered by the assembly from power transients. Over voltage protection shall be provided for the power distribution assembly and shall contain as a minimum, a surge arrester which shall reduce the effect of power line voltage transients and be rated as follows:

Recurrent peak voltage	212 V
Energy rating (maximum)	50 J
Power dissipation, average	0.85 W
Peak current for pulses less than 6 μ s	2,000 A
Standby current for 60 Hz sinusoidal	1 mA or less

The Contractor shall install a thermostatically controlled fan in the Type 334-TV cabinets. The fan shall provide shall provide 150 cfm of ventilation. The fan shall be activated when the temperature inside the cabinet exceeds 24°C and shut off when the temperature is less than 18°C. All vents shall be filtered.

The Contractor shall provide prime power to the cabinet and perform all internal wiring in accordance with these special provisions and plans.

The Contractor shall provide all necessary mounting hardware and wiring to install and commission the equipment in new and existing cabinets as shown on the plans. The Contractor shall test all cabinet assemblies and demonstrate the correct function of all controls in the presence of the Engineer.

The Contractor shall construct each Type 334-TV cabinet foundation as shown on the plans including furnishing and installing anchor bolts, and shall make all field wiring connections to the cabinet.

All cabinet assemblies shall be tested to demonstrate the correct function of all controls in the presence of the Engineer.

Full compensation for modifying and installing the Type 334-TV cabinets, as described in these special provisions and as shown on the plans, shall be considered as included in the contract lump sum price paid for the various items of work requiring Type 334-TV cabinets at various locations and no additional compensation will be allowed therefor.

SINGLE FIBER OPTIC VIDEO TRANSCEIVER

Single fiber optic video transceiver (transmitter) shall be installed at every CCTV location and single fiber optic video transceiver (receiver) shall be installed at the video node. An additional single fiber optic video transceiver (transmitter) shall be installed at the video node and a single fiber optic video transceiver (receiver) shall be installed at the data node.

The single fiber optic video transceiver shall be compatible with EIA RS-170, NTSC, PAL and SECAM and shall be interchangeable and compatible with models IFS VT9930 Transceiver (transmitter) and IFS VR9930 Transceiver (receiver).

The single fiber optic video transceiver shall accept any NTSC baseband video signal and convert it to an optical signal suitable for launching into a single mode fiber.

Both single fiber optic video transceivers (transmitter and receiver) shall utilize lasers and wave length division multiplexing to transmit video and 2 way data pan and tilt control signals over one strand of standard 9/125 single mode fiber optic cable.

The single fiber optic video transceiver shall have LED power indicator to show presence of input power and shall be fully color compatible. The unit shall provide for transmission for video and data signals over distances of up to 66 km without requiring manual adjustments. All printed boards shall be manufactured from Mil-Grade specification circuit board type material. The unit shall be available for both rack mount and for surface mount installations. The housing shall be all metal construction with all connections identified with silk screened labels. The unit shall have solid state limiters on all power lines which shall provide automatic reset. The rack mount configurations shall have an internal D.C. power supply and a short circuit in one unit shall not affect the operation of any other unit powered from a common power supply. The rack units shall also be interchangeable with no risk of damage to other units during replacement.

Features:

Lasers both directions	1300/1550 nm Single Mode
Loss Budget	23 dB
Transmission	FM video, Fsk Data
Signal Noise	60 dB Minimum
Minimum Transmission Distance	76 km
Data	RS-232, RS-422, RS-485, Manchester and Bi-phase encoding
Operating temperature	-40° to +74°C
Medium haul transmission	Compliant to the requirements of EIA RS-250c
Temperature, shock, vibration, humidity and voltage transient protection	Compliant to the requirements of Caltrans Traffic signal control equipment specification and NEMA

Specifications:

Video output	1 volt peak to peak (per RS-170 standard)
Bandwidth	5hz-10Mhz min @ 3 dB
Differential Gain	<3%
Differential Phase	<1.3 degrees
Tilt	<1%
Signal-noise ratio	60 dB
Data compatibility	RS232,RS422,RS485, two wire (NRZ, NRZI, MANCHESTER, BIPHASE)
Data Rate	DC-100 kbps (NRZ)
Bit Error rate	<1 in 10 to the ninth @ 23 dB Optical loss budget
Operating Mode	Simplex or Full Duplex
Storage Temperature	-40 degrees C to +85 degrees C
Relative Humidity	0% to 95% (non condensing)
Wavelength	1300/1550 nm, single mode
Number of fibers	1
Power	24 VAC C.T. @ 5 W
MTBF	>100,000 hours
Connectors	DB-9P
Data	Type DB-25S
Video	BNC (gold plated center pin)
Optical	Type ST or Type SC

The Contractor shall connect the correct optical fiber strands to the optical connector on the single fiber optic video transceivers. The Contractor shall neatly train all fiber strands together when routing them along the same path and the support rails in the equipment racks. No cables shall be installed with a bend radius less than the manufacturer's minimum recommended bending radius.

The Contractor is responsible for all testing and documentation required for approval and acceptance of the production, installation and operation of these materials and equipment. All indicators shall be verified to function correctly.

The Contractor shall input a video test signal into the single fiber optic video transceiver (Transmitter) and use a variable optical attenuator to set the optical power at the single fiber optic video transceiver (transmitter) to its sensitivity level. The optical signal shall then be connected to the single fiber optic video transceiver (receiver) with a video display monitor connected to its output. The Engineer shall then qualitatively assess the video display monitor output. The signal-to-noise and signal-to-low frequency noise shall be measured and recorded.

Attention is directed to "System Testing and Documentation," elsewhere in these special provisions regarding testing the single fiber optic single video transceivers.

CLOSED CIRCUIT TELEVISION CAMERA ASSEMBLY

The closed circuit television (CCTV) camera assembly shall consist of a Digital Signal Processing (DSP) Color video camera unit, camera lens, enclosed camera control cables and connectors and camera housing. The CCTV camera assembly shall be protected from brown outs and voltage spikes to 1000 V or brown outs.

The Contractor shall verify that the units work in accordance with manufacturer's specifications before installation. All CCTV camera assembly equipment shall also be tested after installation as described elsewhere in these special provisions.

CLOSED CIRCUIT TELEVISION DIGITAL SIGNAL PROCESSING (DSP) COLOR VIDEO CAMERA UNIT

The CCTV digital signal processing (DSP) color video camera shall operate reliably under a full range of environmental and lighting conditions and shall provide clear and usable images. All cameras supplied on this project shall be fully interchangeable and meet the following specifications.

All DSP color video cameras shall be of solid state design, and shall meet the following requirements:

Performance.--The following are the performance specifications for the camera:

Optical device	Color CD interline transfer
Optical device size	13 mm
Pixels	682 (horizon.) x 492 (vertical) min.
Horizontal resolution	430 television lines minimum
Minimum usable illumination	1 lx (measured with f1.4 lens)
Scanning system	525 lines 2:1 interlace. No interlace jitter or line pairing on the viewing monitor shall be discernible
Back focus adjustment	Required
Frame frequency	30 frames per second
Width to height aspect ratio	4:3.

The system shall be capable of providing clear, low-bloom and low-lag video pictures under all conditions from bright sunlight to night time scene illumination.

White Balance:

Auto: Color quality shall be maintained by a continuous through the lens automatic white balance system for color temperatures from 2850K to greater than 5100K with less than 10 IRE units unbalance.

Set : Allows user to set white as preferred. For instance, the camera could be focused on an Off White scene and Set to white balance. The camera will then automatically track color temperature changes, biasing the auto white balance on the Off White instead of the factory defined white.

Lock: Locks the white balance at the current levels.

Indoor: Sets the White to be consistent with 3200K

Outdoor: Sets the White to be consistent with 5100K

Fluorescent: Sets the White to be consistent with Fluorescent Lighting

Electrical Specifications.--The following are the electrical specifications for the camera:

Operating voltage	115 VA. @ 50/60 Hz. (±10%)
Heater Power Input Requirements:	115 VAC @ 50/60 Hz. (±10%)
Power Consumption:	7 W with Heater Off; 12 W with Heater On
Video output signal	Standard NETS color TV
Motorized-Iris connector	Required
Gamma:	0.45
Sensitivity (3200K): Full Video, AGE off, iris @ f/1.6, shutter @ 1/60: 80% Video, AGE on, Iris @ f/1.6, shutter @ 1/60 : 30% Video, AGE on, Iris @ f/1.6, shutter @ 1/60: 30% Video, AGE on, 1/4-second integration:	110 lug scene illumination (8.5 lug faceplate illume.) 10 lug scene illumination (0.8 lug faceplate illume) 2 lug scene illumination (0.16 lug faceplate illume) 0.125 lug scene illume. (0.01 lug faceplate illume) Note 1: Scene Illumination is based on 100% reflectance.
Video output connector	Standard NBC bulkhead on rear of camera
Imager:	Interline transfer micro-lens CD with mosaic-type color compensating filter.
Image Area	3.6 mm (H) x 2.7 mm (V) [Format]
Resolution:	460 horizontal; 350 vertical- NETS
Digital Zoom Range:	Digital Zoom Range: 1X (Off) through 8X
Effective Digital Focal Length:	85.8mm to 686.4mm
Horizontal Angle of View:	48.94 to 2.51 At 8X Digital: to 0.31
Minimum Focus Distance:	0.7 at max. wide; 29.5 at max tele
Auto Focus:	Selectable Auto/Manual. Minimum Scene Illumination for Reliable Auto Focus, 30% video
Zoom & Focus Presets:	64 preset positions (Note: recalling a preset position puts camera into manual focus mode)
Long Term Integration Range:	Provides manual selection of integration duration for enhanced sensitivity. Integration times are 1/4 second, 1/8 second, 1/15 second, 1/30 second. Frame Store video output provides continuous video output, updated at the integration rate.
Signal to noise ratio	56 dB (HPF: 200 kHz; LPF: 6 mHz; Weighted, Minimum Camera Gain, Lens Capped)
Synchronization	Internal Crystal sync or line lock
Video output level	1.0 V p-p (75 composite), unbalanced, NTSC
Gain control	Automatic
Automatic white balance:	Required

The Contractor shall provide the camera with a suitable power supply that operates with an AC input voltage.

The camera shall have automatic gain control (AGC) from 0 to 16 dB in order to be able to handle the range of lighting extremes from very low light night scenes to full sunlight conditions. If the AGC control is switchable, the Contractor shall set the AGC to the "on" position.

The camera shall be equipped with an electronic shutter with adjustable speeds. Manual Shutter: Selectable shutter speeds of 1/60, 1/100; 1/250; 1/500; 1/1,000; 1/2,000; 1/4,000; 1/10,000 second. Auto Shutter: Automatically controls shutter speed between 1/60 and 1/10,000 second to maintain correct video level output. Auto Iris: Iris automatically adjusts to compensate for changes in scene illumination to maintain constant video level output within sensitivity specifications. Manual Iris: In the manual iris mode the iris opens and closes in steps.

The Contractor shall set the shutter speed of the camera at 1/60th of a second.

Physical Specifications.--The following are the physical specifications for the camera:

Lens mount	C type
Camera mount	6 mm - 20 UNC (minimum of two located on bottom)
Maximum weight	0.73 kg without lens
Maximum dimensions	70 mm (H) x 70 mm (W) x 216 mm (D) (body)

Environmental Specifications.--The following are the environmental specifications for the camera:

Operating temperature	10°C to 50°C
Storage temperature	-40°C to 60°C
Operating humidity	20 to 80% non-condensing
Storage humidity	20 to 90% non-condensing

Shock and Vibration Specifications.--The following are the shock and vibration specifications for the camera:

Shock	15 g
Vibration	5-60 Hz with 2.0 mm total excursion, and 5 g rms vibration from 60-1000 Hz.

The CCTV camera shall not incur any physical damage after a shock, return to normal operation immediately and operate within the specified vibration.

Installation.--The Contractor shall install and fully adjust the camera with the associated lens, power supplies, housings, and all necessary cabling, etc., to make the assembly completely operational.

The Contractor shall firmly attach the camera to the housing enclosure. The Contractor shall exercise care to tighten the camera mount within the torque limits specified by the camera manufacturer.

The Contractor shall properly terminate all of the electrical cables to the camera and firmly attach them.

The Contractor shall dress and secure the electrical cables inside the housing and cabinet so that they do not interfere with the closing of the cabinet, with the fan or with any other moving part.

The camera shall be mounted in the housing within 6 mm of the optical window. This distance is-measured with the lens attached and adjusted to its maximum physical length.

The Contractor shall mount the camera in the housing enclosure such that the lens is centered in the optical window.

The Contractor shall adjust the back-focus adjustment on the camera such that the lens focus is properly set and maintained over the zoom range. This adjustment shall be made such that when the zoom is adjusted from long range (telephoto) to wide angle that no refocusing is necessary.

The Contractor shall provide five copies of the operation and maintenance manuals for the camera.

CLOSED CIRCUIT TELEVISION CAMERA LENS

The CCTV camera lens shall work properly in conjunction with the camera as well as all of the other video system components. It shall operate reliably and produce clear images when properly adjusted and meet the following specifications.

The CCTV camera lens shall be an integral component of the specified camera. The lens shall be factory assembled, back-focused, and adjusted during manufacturing of the camera. Separate camera and lens combinations shall not be accepted. The lens shall provide an adjustable focal range of 22X, 3.9 mm to 85.8 mm @ minimum F1.6. The camera/lens shall provide auto iris with manual iris over-ride capabilities.

Performance.--The following are the performance specifications for the lens:

Format	13 mm, minimum
Mount	C
Zoom magnification range	10:1
Zoom focal length range	7.5 mm to 75 mm, or 8 mm to 80 mm
Aperture range	F1.2 to F560, minimum
Iris type	Motorized iris

Electrical Specifications.--The following are the electrical specifications for the lens:

Operating voltage	±12 VDC
Iris position without power	Closed

When the camera is pointed at a very bright object and or when the camera and lens is first turned on, the image produced by the lens and camera combination should not optically "oscillate" (i.e., produce an image that alternates from too light to too dark) or otherwise be unstable. The lens and camera combination should react to temporary overload situations (such as described above) in a smooth and rapid fashion and with minimum overshoot.

The motorized-iris cable shall be strain relieved or sufficiently rugged such that the cable will not fail at the point where it leaves the lens assembly.

Optical Specifications.--The following are the optical specifications for the lens:

When the power is removed from the lens, the lens iris shall automatically close.

The lens shall incorporate an integral variable-density filter.

The lens shall include mechanical and/or electrical means to protect the motors from over running in the extreme position.

Environmental Specifications.--The following are the environmental specifications for the lens:

Operating temperature	-10°C to +50°C (min. range).
Storage temperature	-40°C to 60°C
Operating humidity	20 to 80% non-condensing
Storage humidity	20 to 90% non-condensing

Shock/Vibration Specifications.--The following are the shock and vibration specifications for the lens:

The lens shall be constructed such that it is able to withstand the vibration that it will be subjected to when mounted in the camera housing in all locations specified.

The auto-iris function shall not be affected by normal vibration.

The focus and zoom mechanism shall not be affected by normal vibration.

The lens shall be constructed such that it is able to withstand the shock that occurs during shipment and normal installation.

Presets.--The lens shall be supplied with zoom and focus preset position.

Installation.--The Contractor shall adjust the back-focus adjustment on the camera such that the lens focus is properly set and maintained when adjusting the focal length from zoom to wide angle. The Contractor shall make this adjustment with the lens iris at full open position. This adjustment shall be made such that when the zoom is adjusted from long range (telephoto) to wide angle, no refocusing is necessary.

The Contractor shall properly terminate the motorized iris electrical cable and connect it between the lens and the camera body.

The Contractor shall provide operation and maintenance manuals for the lens as described under "System Testing and Documentation" elsewhere in these special provisions.

CAMERA HOUSING

The camera housing shall house the camera and CCTV camera lens. It shall protect the camera and CCTV camera lens from rain, dust, wind and other elements. It shall offer ease of accessibility for maintenance, have a sufficiently large interior dimension to house the camera and lens, offer a means of securing the camera and lens and allow for entry of required cables to make an operational system. The camera housing shall be mounted to the pan and tilt unit specified elsewhere in these special provisions.

The contractor shall furnish and install a corrosion resistant and tamperproof sealed and pressurized housing with five pounds psi dry nitrogen with schrader purge fitting and 137.9K Pascals relief valve for each camera. The size of the housing shall be 90 mm diameter or smaller.

The camera housing shall include a loss of pressure sensor that will trigger an alarm message that will be inserted in the video output signal.

The camera/lens/housing shall be assembled and tested and configured only by the camera manufacturer at the camera manufacturer facility. The camera shall have been adjusted for color balance and lens tracking/focus, and all configurable items shall have been properly set per specifications. Each camera/lens/housing delivered to the project site shall be accompanied with a written certification of assembly and configuration from the camera manufacturer. This certification shall serve as the manufacturer documentation that the assembly and configuration of the camera/lens/housing equipment was performed. A sample certification document shall be furnished as part of the materials submittal data.

The enclosure shall be constructed from 6061-T6 standard aluminum tubing with a wall thickness of 5mm +/- 2mm. Internal components shall be mounted to a rail assembly. A copper plated spring-steel ring shall be used to ensure electrical bonding of the rail assembly and components to the camera housing. The housing exterior shall be finished by pre-treatment with a conversion coating and baked enamel paint.

The camera enclosure shall be designed to withstand the effects of sand, dust, and hose-directed water. All connections shall be watertight.

A gas-tight connector shall be used at the rear plate of the housing. Wiring to the connector shall be sealed with silicon or potting compound.

The internal humidity of the housing shall be less than 10 percent, when sealed and pressurized. Desiccant packs shall be securely placed inside the housing to absorb any residual moisture and maintain internal humidity at 10 percent or less.

The viewing window shall be constructed in such a way that unrestricted camera views can be obtained at all camera and lens positions.

A sun shield shall be provided to shield the entire housing from direct sunlight. It shall be constructed in such a way as to allow the free passage of air between the housing and the shield, but shall not form a sail to place an excessive load on the pan/tilt unit in high winds.

Each housing shall be provided with an internal 115 VAC, 5 W low temperature heater with its own thermostat control.

Mechanical Specifications

Weight:	1.9 kg
Length (less connectors):	300 mm
Housing Diameter:	90 mm
Height (Including mounting base)	130 mm
Mounting:	4 mounting 6.35 mm 20 UNC on enclosure bottom of base. Platform mount with adjustment fore & aft
Interior Dimensions	Suitable for camera, lens & wiring
Pressure valve	Schraeder type w. pressure relief

The housing shall protect the camera and lens assembly from dirt, rain and other adverse environmental conditions.

The housing shall be purge pressurized by the contractor during installation. The pressure shall be between 48 kPa to 69 kPa 7 to 10 psi and the pressurizing gas shall be dry nitrogen.

The interior of the housing unit shall provide an adjustable camera sled for mounting the camera and lens assembly.

If cameras of low centerline profile are used, then the contractor shall provide a means of elevating the camera for proper lens clearance. The Contractor shall position the lens in the center of the housing window.

The housing enclosure shall include a sun shield or shroud. The purpose of the sun shroud shall be to protect the housing enclosure from the direct rays of the sun and to reduce the internal temperatures of the enclosure by at least 10° F. The sun shroud shall be made specifically for the model of housing enclosure that is selected.

Contractor shall provide any adapter plates required to mount positioning system to pole.

Shock/Vibration Specifications

Shock	15 g
Vibration	5-60 Hz with 2.08 mm total excursion, and 5 g's rms vibration from 60-1000 Hz.

The camera housing shall not incur any physical damage after a shock, return to normal operation immediately and operate within the specified vibration..

Electrical Specifications

Power requirements	120 VAC \pm 15%, 60 Hz \pm 5%
Power consumption	Less than 170 W
Heater Operation	Thermostatically controlled turn-on for internal temp < 4°C.
Elect. Connector	Single sealed multi-pin for all video, power and control cabling

Environmental Specifications

Ambient Temperature Limits (Operating):	-40°C to 60°C (-40°F to 140°F)
Ambient Temperature Limits (Storage):	-30°C to 70°C (-22°F to 157°F)
Humidity:	Up to 100% relative humidity (per MIL-E-5400T, paragraph 3.2.24.4)
Other:	Withstands exposure to sand, dust, fungus, and salt atmosphere per MIL-E-5400T, paragraph 3.2.24.7, 3.2.24.8, and 3.2.24.9.

Installation.--Upon completion of the installation by the Contractor, the Engineer shall verify proper installation of the housing and camera/lens assembly.

PAN AND TILT UNIT

The pan and tilt unit will consist of the pan and tilt unit itself along with any electrical or communication interfaces required to perform the functions specified. The pan and tilt unit shall operate reliably over extended periods of time with little or no maintenance, be environment and weather-resistant under a full range of environmental conditions and provide repeatable day-to-day operation. The pan and tilt unit will be compatible with the COHU 3855-1000/PED series, or equal and as approved in writing by the Engineer.

Performance.--The pan and tilt unit shall meet the following performance specifications:

Load Rating	Greater than 36.3 kgs
Braking: Pan and Tilt	Mechanical or Electrical to limit coasting
Overload Protection	Motors: Impedance protected
Construction	Corrosion resistant steel or aluminum
Angular Travel	Pan: At least 350 degrees Tilt: At least +30 degrees to -90 degrees
Motor Reversal	Instantaneous

The pan and tilt unit with camera assembly mounted shall be able to withstand a wind load of 145 km/h

Electrical Specifications.--The pan and tilt unit shall meet the following specifications:

Power requirements	120 VA. \pm 15%, 60 Hz \pm 5%
Power consumption	less than 100 W
Duty cycle	Pan: continuous Tilt: intermittent
Pan/Tilt position preset	Enables preset position to a predetermined Azimuth, elevation and lens position
Motor type	High Speed Stepper
Variable speed	Motor Technology

Physical Specifications.--The pan and tilt unit shall meet the following physical specifications:

Size	Less than 406 mm H x 356 mm W x 203 mm D
Weight	Less than 25 kg
Pan Speed	Greater than or equal to 6 degrees / second
Tilt Speed	Greater than or equal to 3 degrees / second
Gears	Hardened steel
Mounting (Base)	178 mm + 3 mm
Camera Mount	Compatible with camera housing
Bearings on Rotating Surfaces	Heavy duty roller type
Overload Protection	Provided - internal

Shock/Vibration Specifications.--The pan and tilt unit shall meet the following vibration specifications:

Shock	15g
Vibration	5-60 Hz with 2.08 mm total excursion, and 5 gs rms vibration from 60-1000 Hz

The pan and tilt unit shall not incur any physical damage after a shock, shall return to normal operation immediately and shall operate within the specified vibration.

Environmental Specifications.--The pan and tilt unit shall meet the following environmental specifications:

Operating temperature	-23°C to + 60°C
Finish	Weather resistant paint or polyurethane
Seals	"O" ring or gaskets for all weather protection of Pan and Tilt Unit and cables.

Pan and Tilt Stops.--The pan and tilt unit shall have pan and tilt stops, the setting shall be determined by the Engineer. Pan and tilt stops shall have both mechanical and electrical stops.

Installation.--

The Engineer will notify the Contractor of the pan and tilt stops for the pan and tilt unit for the Contractor to set prior to installation check. Installation check shall be done by the Contractor in the presence of the Engineer. The operation of the pan and tilt unit will be performed at the Type 334-TV Cabinet adjacent to the camera or sign truss pole(s) where the camera is mounted. The Contractor shall furnish a color video monitor, for testing only, to view the actual camera image. The Engineer shall direct adjustments for pan and tilt presets and pan and tilt stops, to be made by the Contractor. Upon completion of the installation, the Engineer shall verify operation of the pan and tilt unit.

The Contractor shall provide five copies of the operation and maintenance manuals for the pan and tilt unit.

10-3.25 COMMUNICATION EQUIPMENT

The Contractor shall arrange to have a technician, qualified to work on the communication equipment and employed by the communication equipment manufacturer or his representative, present at the time the equipment is turned on.

Prototype equipment is not acceptable. All equipment shall be current standard production units and shall have been in production for a minimum of six months. Rebuilt or reconditioned equipment will not be allowed.

All equipment racks shall be industrial grade and conform to EIA standard RS-310-D.

All rack mounted equipment and card cage assemblies shall have metal filler plates to cover any unused channel slots or card slots.

WORK AT THE REGIONAL TRAFFIC MANAGEMENT CENTER (RTMC)

The Regional Traffic Management Center (RTMC) building is located at Route 2 / Route 134 separation

The work at the RTMC shall consist of terminating new 72 singlemode fibers from the Data Node (Location GL031) and the Video Node (Location GL131) with the existing 72 singlemode fibers at the existing splice vault located near the existing RTMC.

The three fibers to be spliced shall be determined by the Engineer.

The Contractor shall install RS232 port expander and RS232 asynchronous card in existing D4 channel bank rack in the RTMC.

Full compensation for the work at the Regional Traffic Management Center shall be considered as included in the contract lump sum prices paid for the closed circuit television camera at various locations and no additional compensation will be allowed therefor.

CABLE NODE

Cable nodes shall be installed at Route 2 / Route 210 separation and Route 2 / Route 5 separation as shown on plans

The cable node shall consist of a Type 334-TV cabinet and a cable node assembly and other equipment housed in a Type 334-TV cabinet as shown on plans.

The cable node assembly shall consist of two No. 50 pair terminal blocks and a fiber distribution unit (FDU) . The fiber distribution unit shall consist of termination and distribution cable tray assembly for 72 singlemode fibers or more. The termination and distribution cable trays shall have sufficient tray area for excess optical fiber storage with provisions to assure that the optical fibers do not exceed 51 mm bend radius.

The termination and distribution cable trays shall include a designation strip for identification of the 72 singlemode fibers. All fibers shall be labeled in the splice tray with permanent vinyl markers. Fiber bonds shall also be labeled to identify the physical designation of each individual fiber strand.

VIDEO NODE

Video node shall be installed at Route 2 and Route 210 separation.

The video node shall consist of video multiplexer, rack-mounted single fiber optic video transceivers (receiver and transmitter), RS232 port expander, and other equipment, housed in a Type 334-TV cabinet, as shown on the plans to provide full equipment operation.

VIDEO MULTIPLEXER AND DEMULTIPLEXER

The video multiplexer shall consist of FM (Frequency Modulation) video modulators, a RF (Radio Frequency) combiner, splitter, and a singlemode fiber optic transmitter. The demultiplexer shall consist of a fiber optic receiver, RF splitter and FM video demodulators. The video multiplexer and demultiplexer shall be connected by singlemode optical fiber to form video link. A video link shall provide point-to-point transmission of at least 16 full motion, NTSC baseband video signals.

The video multiplexer and demultiplexer shall mount in an EIA 482 mm equipment rack, either as separately mountable sub-units or as a card cage. The equipment shall include all necessary hardware mounting and adapters. The video multiplexer and the demultiplexer, including power supply, shall each occupy no more than 445-mm of rack space and shall be fully configured for not less than 16 video channels as shown on plans.

Each system component described below shall be mounted on one or more PC boards. In addition, one PC board may support two or more functional components or the partial function of a component with the exception of the power supply, which shall be mounted on a separate PC board or boards. All electronic components shall be mounted on PC boards. The PC boards shall be easily replaceable without requiring special tools.

All specifications for the video multiplexer and demultiplexer equipment shall be met over an operating temperature range from 0°C to 50°C. The power supply for the video multiplexer and demultiplexer equipment shall be powered from a 120 VAC, 60 Hz power receptacle located in the Type 334-TV cabinet as shown on the plans.

Video Modulator

The modulator shall accept any NTSC baseband video signal and convert it to a frequency-modulated electrical signal suitable for mixing or combining with other electrical signals to produce a composite broadband signal to the optical transmitter. The video modulator shall be capable of modulating the input video signal using an FM scheme, onto any one of 16 frequencies in the range of 50 to 550 MHz. The output frequency of the modulator shall be remotely selectable.

Each modulator shall consist of either plug-in modules that fit into the multiplexer card cage or 482 mm rack mountable units. The video inputs to the modulator shall be nickel plated, female BNC connectors with a gold plated contact. The nominal input impedance shall be 75 Ω and the return loss shall be at least 30 dB. Each modulator shall operate as specified with a 0.7 V to 1.4 V peak to peak composite input video signal. The modulator shall continue to operate satisfactorily with an input level of 0.5 V to 2.0 V.

After selection of the appropriate output frequency, any video modulator shall be interchangeable with any other video modulator in the subsystem. A female BNC bulkhead connector of the same design as the video input connector, or a female F bulkhead connector shall be installed at the rear of the module to deliver the modulated signal output. Either type of connector shall be designed to interface with 75 Ω coaxial cable.

Test points shall be provided on the front panel of the video modulator to allow in-service measurement of relevant signals without causing any disturbances in the output of the video modulator. Indicators shall be provided on the front panel of the video modulator to allow operator verification of the correct performance of the video modulator.

RF Combiner and Splitter

The RF combiner and splitter shall be capable of combining the outputs of 16 video modulators. It shall operate over the frequency range of 5 to 600 MHz. In addition, it shall provide attenuation of each input that is uniform across all inputs within ± 1 dB. The RF combiner and splitter shall provide a high degree of isolation between each input with the worst case isolation being 30 dB at 550 MHz.

The RF combiner and splitter shall provide a return loss of greater than 20 dB at all taps. It shall have an input and output impedance of 75 Ω and shall be constructed with female F bulkhead connectors. All unused RF combiner and splitter inputs and outputs shall be terminated with 75 Ω resistive loads.

Fiber Optic Transmitter

The fiber optic transmitter shall accept the output from the RF combiner and splitter in the configuration of various video modulators in quantities as shown in the plans. The bandwidth of the input of the fiber optic transmitter shall be 5 to 550 MHz. The fiber optic transmitter shall use a laser with center wavelength of 1300 nm to 1330 nm at 24°C, with the spectral width not to exceed 10 nm. The laser shall operate at 1310 nm and shall provide an optical launch power of 0 dBm. The combined electrical signal from the modulators shall modulate the laser and be coupled into a singlemode optical fiber. The transmitter launch power shall be defined as the power launched by the laser into one meter of step-index optical fiber having a mode field diameter of 10 μm . The transmitter launch power shall be at least 20 dB greater than the receiver sensitivity and greater than -8 dBm.

A female BNC bulkhead connector, or a female bulkhead connector shall be installed at the rear of the module to accept the input signal from the RF combiner and splitter. Either type of RF connector shall be designed to interface with 75 Ω coaxial cable. The fiber optic transmitter shall use an ST style compatible connector and be compatible with the fiber optic cable Type ST connector mating connector on the fiber optic cable specified in these special provisions.

Test points shall be provided on the front panel of the fiber optic transmitter to allow in-service measurement of relevant signals without causing any disturbances in the output of the fiber optic transmitter.

Indicators shall be provided on the front panel of the video modulator to allow operator verification of the correct performance of the fiber optic transmitter. The video transmitter shall be capable of interfacing with and operating over fiber optic cable as specified elsewhere in these special provisions.

Fiber Optic Receiver

The fiber optic receiver shall receive the optical signal launched into a singlemode optical fiber by the transmitter and output an electrical signal suitable for splitting and demodulating. The fiber optic receiver shall employ an avalanche photo diode (APD) as the input sensing device. The receiver shall be designed to operate in accordance with the above indicated special provisions with an optical input power range of -8 dBm to -20 dBm. The fiber optic receiver shall provide sufficient RF output power to directly drive, or feed a wide band RF line amplifier to drive, a minimum of 16 video demodulators to at least middle range of the demodulators required input power levels. The input power level to any of the video demodulators shall not be effected by loading changes to the other video demodulators feed by the fiber optic receiver.

The fiber optic receiver shall be equipped with an AGC system that shall maintain an RF signal output level consistent with the requirements of the video demodulator under varying optical power input conditions. A front panel control shall be provided to allow operator override and adjustment of the AGC system within ± 5 dB of the nominal output level.

The fiber optic receiver shall be compatible with the fiber optic cable specified in these special provisions. The fiber optic receiver shall be equipped with a Type ST connector compatible with the mating connector on the fiber optic cable. A female BNC bulkhead connector, or a female bulkhead connector shall be installed at the rear of the module to deliver the output signal. Either type of connector shall be designed to interface with 75 Ω coaxial cable.

Test points shall be provided on the front panel of the fiber optic receiver to allow in-service measurement of relevant signals without causing any disturbances in the output of the fiber optic receiver.

Indicators shall be provided on the front panel of the fiber optic receiver to allow operator verification of the correct performance of the fiber optic receiver.

Video Demodulator

The video demodulators shall consist of either plug-in modules that fit into the demultiplexer card cage or 482 mm rack mountable units. The demodulators shall convert the RF signal output of the fiber optic receiver, with a bandwidth of 50 to 550 MHz, to an electrical baseband NTSC video signals.

The video demodulator shall be capable of demodulating any one of 16 frequencies in the range of 50 to 550 MHz comprising the input RF signal. The frequency to be demodulated shall be selectable by the operator. The video

demodulator shall provide as an output one baseband video signal as specified by the RS-170 Standard. After selection of the appropriate frequency, any video demodulator shall be interchangeable with any other video demodulator in the subsystem.

A female BNC bulkhead connector shall be installed at the rear of the video demodulator to accept the RF input signal. The connector shall be designed to interface with 75 cable. A female BNC bulkhead connector shall be installed at the rear of the video modulator to deliver the output video signal. The female BNC connector shall be nickel plated except for the center contact which shall be gold plated. The female BNC connector shall be designed to interface with a 75 coaxial cable.

Test points shall be provided on the front panel of the video demodulator to allow in-service measurement of relevant signals without causing any disturbances in the output of the video demodulator.

Indicators shall be provided on the front panel of the video demodulator to allow operator verification of the correct performance of the video demodulator.

Rack Frame and Power Supply

The rack frame and power supply shall contain all of the various modules of the video multiplexer and video demultiplexer. The rack frame and power supply shall provide power to all of the modules contained therein and shall operate from input power supply of 120 VAC ± 15 percent, 60 Hz ± 5 percent. The rack frame and power supply shall be suitable for installation in an EIA standard 482-mm equipment rack.

Modules not designed to be contained in the rack frame and power supply shall be suitable for installation directly into an EIA standard 482-mm equipment rack and shall be powered directly from a power supply of 120 VAC ± 15 percent, 60 Hz ± 5 percent.

Fiber Optic Attenuator

The fiber optic attenuator shall be suitable for installation at the receiver end of the optical signal path. The value of each fiber optic attenuator shall be such that, for each optical signal path into which a fiber optic attenuator is inserted, the optical power level delivered to the respective fiber optic receiver is at least three dBm above the minimum level required, and does not exceed the maximum level acceptable by the fiber optic receiver. Fiber optic attenuators shall be provided if the saturation level of the receiver minus the received signal level is greater than one dB.

Installation

All components of the video multiplexer and demultiplexer shall be installed at the locations and in the quantities as shown in the plans. Installation shall include all required interface cable types as specified in these special provisions. All blank module slots in rack frame and power supply assemblies shall be filled with a plate of similar construction and finish consistent with those of the modules. The filler plate shall be field removable without requiring special tooling or any disassembly of the system. The system shall provide the ability to remove and replace any module in the system without requiring that the power supply be turned off and without disturbing the operation of any other modules in the same rack frame and power supply assembly. All modules shall be labeled on the front panel to identify the video signal or fiber passing through the module. The labeling technique shall be such that all labels are neat and legible and shall be removable and replaceable to allow for substitution of modules in the event of failure.

Testing

The Contractor shall test all modules and components prior to installation in accordance with the manufacturer's test procedures in the presence of the Engineer and shall furnish documentation demonstrating the compliance of all modules of these special provisions.

RS232 Port Expander

The RS232 Port expander shall operate with any combination of 8 DTEs or DCEs, and for synchronous or asynchronous up to 19.2 kbps.

The RS232 Port expander shall unit shall feature:

- RTS/DCD or data contention.
- DCE/DTE switch for main and each sub-channel.
- Automatic disabling of sub-channel in event of streaming.
- Individual sub-channel manual disable switches.
- Internal or external clocks.
- 1U height for minimal rack space
- Cascadeability

The RS232 port expander shall be able to enable up to 8 modems or terminals to share a master modem (RS232 port expander), a multiplexer or a computer port in a multi point environment. It shall operate at seven selectable data rates up to 19.2 kbps, synchronously or asynchronously.

The RS232 port expander shall feature or be able to:

- Support for three clocks

- Internal

- External from the main channel

- External from DCE connected to sub-channel 1.

- Power supply of -48 V DC (default 115 / 230 VAC switchable)

- Buffer that shall be able to switch-select for equipment which must provide clock to multiple sub-channels.

Information shall be broadcasted by the main channel to all sub-channels in parallel. Sub-channel shall transmit to the main channel by activating RTS/DCD or by data transition. If the RTS/DCD or data of a sub-channel is active, the sub-channel's transmit data and or control signals shall connect to the main channel. When RTS/DCD drops or data transmission ceases, the control circuitry shall switch to monitor or other channels.

A sub-channel shall disconnect after it drops RTS/DCD or transmits 16 idle bits.

In the event of streaming a sub-channel shall be able to be disabled by automatic circuitry if it remains active for a preset time. The automatic disable shall reset whenever the sub-channel RTS/DCD drops, or 16 idle boits are transmitted (data contention). Front panel indication shall be provided for each sub-channel disabled by automatic circuitry.

The sub-channel shall be manually disabled from the front panel as an alternative.

RS232 port expander shall be mountable on a standard 480 mm rack and shall be compatible with the RAD RSD-10 Digital Sharing Device

Payment

Full compensation for furnishing all labor, materials, tools, equipment, and incidentals required to provide fully equipped and operating system, and for doing all the work involved in the video node shall be considered as included in the lump sum price paid for closed circuit television camera (Location GL131) and no additional compensation will be allowed therefor.

DATA NODE

Each data node shall consist of a D4 channel bank equipped with channel cards and a DS-1 optical modem, a single fiber optic transceiver (receiver), a FDU, two 50 pair terminal block and other equipment, housed in a Type 334-TV cabinet. The channel cards supplied for each channel of the 24 channel D4 channel bank unit shall be as indicated on the Data Node Circuit Assignment Tables as shown on the plans.

In addition to what is shown on the plans each D4 channel bank shall contain one each 4-wire transmit only (4WTO) and one each 2-wire foreign exchange (FXS) channel card for a protection circuit and one each RS232 asynchronous card. The equipment shall also include any ancillary or incidental items required to provide full equipment operation at each site.

The Type 334-TV cabinet is specified elsewhere in these special provisions

The fiber distribution unit shall consist of termination and distribution cable tray assembly for 72 singlemode fiber optic cables or more. The termination and distribution cable trays shall have sufficient tray area for excess optical fiber storage with provisions to assure that the optical fibers do not exceed 51-mm bend radius.

The termination and distribution cable trays shall include a designation strip for identification of the 72 singlemode fiber optic cables. All fibers shall be labeled in the splice tray with permanent vinyl markers. Fiber bonds shall also be labeled to identify the physical designation of each individual fiber strand.

Channel Bank

The D4 channel bank equipment shall include a DS-1 optical modem, RS232 asynchronous expander and a single fiber optic transceiver (receiver). This equipment will be used to digitize the narrow bandwidth analog and quasi-analog signals and to time-division multiplex them into a 1.544 Mb/s composite data signal. The D4 channel bank shall satisfy the following requirements:

Physical:

Operating temperature	0°C to 50°C
Relative Humidity	95 percent non-condensing

Dimensions:

Height	less than 457 mm
Width	482 mm
Depth	less than 508 mm

Electrical:

Line Rate	1.544 Mbps \pm 200 bps (stratum 4)
Line Code	AMI or B8ZS (user selectable)
Sampling Format	D4
Framing Format	ESF
Line Impedance	100 \pm 10
Power Input	120 VAC \pm 10 percent at 60 Hz \pm 3 H, 3 A minimum

The D4 channel bank shall be fully configured to house up to 24 DS-O channel cards at 64 kbps framing with 8 kbps overhead and shall multiplex up to 24 voice or data channels for transmission over a DS-1 data channel. The channel bank shall be type-accepted in accordance with the FCC Regulations, Part 68. The common card units shall provide the transmit, receive, power distribution, timing, and alarm functions.

The D4 channel bank shall be installed in the standard equipment EIA 482 mm racks as shown on the plans. The D4 channel bank shall be fully connected to the existing DSX-1 jackfield housed in the RTMC building. The D4 shall be cross-connected to the audio jackfield as shown on the plans. The D4 channel bank shall be tested end-to-end from the existing DSX-1 jackfield to the terminal equipment housed in the RTMC (Route 2 / Route 134 separation) building. Each slot within the D4 channel bank shall be individually tested by moving cards from slot-to-slot.

The power supply shall convert 120 VAC to 48 VDC with a 2 A output.

The D4 channel bank shall include the following channel cards of the types and quantities as shown on plans.

4-wire analog with E&M signaling - (4W E&M)

4-wire transmit only (4 WTO)

2-wire Foreign Exchange - Subscriber (FXS)

RS232 asynchronous card

The Contractor shall supply the quantities of each card identified on the plans. The D4 channel bank shall be installed in accordance with the manufacturer's installation instructions.

The Contractor shall adjust the levels of the D4 channel bank to achieve a 0 transmission level point (TLP) at the RTMC (Route 2 / Route 134 separation) building. The Contractor shall measure end-to-end performance of the analog and digital parameters under full operation.

The D4 channel cards shall be designed to physically plug into any of the available channel card slots of the D4 multiplex unit with electrical power on. Each D4 channel card shall use no more than 5 W maximum power supplied by the D4 multiplex unit. The A/D and D/A channel conversion frequency for all channel cards shall be 8000 ± 2 Hz.

The D4 channel cards shall meet all required operating specifications over a temperature range from 0°C to 50°C and with maximum relative humidity of 95%, noncondensing.

All channel cards shall satisfy the following requirements:

Return Loss:	(per AT&T Pub. 43801):
ERL:	28 dB
SRL:	20 dB
Idle Noise, Single Ended:	19 dBrnC0
Idle Noise, End-to-End:	22 dBrnC0
Crosstalk Coupling Loss:	65 dB, 200 to 3400 Hz
C-message weighted.	

4-Wire Analog With E&M Signaling - (4W E&M) --The 4-wire analog with E&M signaling channel card shall meet the following requirements:

Channel Coding Resolution	8 voice bits per channel
Normal Transmission Level Point (TLP)	transmit: -17.5dBm to +8.0dBm receive: -16.9dBm to +8.5dBm
TLP range	-24 to +8 dBm transmit and receive
Drop Impedance	600

Frequency Response (1004 Hz reference):		
Frequency (Hz)	Transmit Level (dB)	Receive Level (dB)
60	< -14 max.	< -14 max
200	-2.0 to +0.15	-1.0 to +0.15
300-3000	±0.15	±0.15
3200	-0.75 to +0.15	-0.75 to +0.15
3400	-1.5 to +0.15	-1.5 to +0.15
4000	< -14 max.	< -14 max.

4-Wire Transmit Only - (4WTO) --The 4-wire transmit only channel card shall meet the following requirements:

Channel Coding Resolution:	8 voice bits per channel
Normal Transmission Level Point (TLP):	transmit: -17.5 dBm to +8.0 dBm receive: -16.9 dBm to +8.5 dBm
TLP range:	-24 to +8 dBm transmit and receive
Drop Impedance:	600

Frequency Response (1004 Hz reference):		
Frequency (Hz)	Transmit Level (dB)	Receive Level (dB)
60	< -14 max.	< -14 max
200	-2.0 to +0.15	-1.0 to +0.15
300-3000	±0.15	±0.15
3200	-0.75 to +0.15	-0.75 to +0.15
3400	-1.5 to +0.15	-1.5 to +0.15
4000	< -14 max.	< -14 max.

2 Wire Foreign Exchange - (2WFXS) --The 2-wire foreign exchange channel card shall meet the following requirements:

Channel Coding Resolution	8 voice bits per channel, 5 of 6 frames, 7 voice bits per channel, 1 of 6 frames, 1 signaling bit per channel, 1 of 6 frames
Normal Transmission Level Point (TLP)	transmit: -17.5 dBm to +2.8 dBm receive: -21.5 dBm to +7 dBm
TLP range	-22 to +8 dBm transmit and receive
Drop Impedance	600 or 900 and 2.15 μ F

Frequency Response (1004 Hz reference):		
Frequency (Hz)	Transmit Level (dB)	Receive Level (dB)
60	-14 max.	-14 max.
200	-3.0 to +0	-2.0 to +0
300-3000	-0.5 to +0.25	-0.5 to +0.25
3200	-0.75 to +0.25	-0.75 to +0.25
3400	-1.5 to +0.25	-1.5 to +0.25

Signaling:

Dial pulse distortion	-5 percent to +3 percent, at 12 PPS, 60 percent break
Pulse rate range	8 to 14 PPS.
Loop length limit	< 2000 without buildout resistors < 1000 with buildout resistors
Ring trip time	250 ms
Ring ground detect range	1500 without buildout resistors 1000 with buildout resistors
Interrupted ringing (PLAR)	2 seconds on and 4 seconds off

RS232 Asynchronous Card - The RS232 Asynchronous Card shall meet the following requirements:

Data Transmission Specifications:

Asynchronous Data rate	Full Duplex Single Channel 19.2 kb/s max Full Duplex Dual Channel: 6 kb/s max
Electrical Interface	EIA:RS232-C CCITT:V.24
Cable length	25 m max
Encoder Format	3 bit transitional coder with mark for idle state
Asynchronous Distortion	15% max for max data rates; proportionally lower for lower data rates
Power requirements Voltages	+5 V, + or - 12 V, supplied by 2430 power supply unit.
Power dissipation	1.0 W nominal 1.4 W max

General Specifications:

Operating Temperature Range	0°C to +50°C
Dimensions Width	120 mm Height, 240 mm Depth, 25 mm Width
Weight	34 kg
Mounting	Telco systems DDI-24 mounting assembly
Electrical Connection	44-pin card edge connector

DS-1 Optical Modem.--The DS-1 optical modem converts the electrical signals of the TDM's aggregate interface and the optical signals used on the single mode optical fiber facility. Two DS-1 optical modems and the fibers connecting them will form the T-1 transmission facility.

The electrical DS-1 interface of the optical modem shall comply with the ANSI T1.102-1987 standard. The physical interface shall be either a 15 pin D-type connector or a 4-position terminal strip with provision for grounding the cables shield. The optical connectors shall be of the ST type. The DS-1 optical modem shall be transparent to any zero-code suppression used by the terminal equipment. If necessary, the output power of each modem shall be externally attenuated to be compatible with the optical loss of the fiber being used.

The optical interface shall be designed for single mode operation using an optical wavelength of between 1300 and 1350 nm. The optical launch power of the transmitter shall be at least 20 dB greater than the sensitivity of the receiver.

Sensitivity is defined as the minimum optical receive power required to maintain the specified error rate. The saturation level is the maximum optical received power that the receiver can tolerate before the error rate is exceeded. At no time shall the received optical power exceed the receiver's saturation level. Fixed optical attenuators with a return loss of greater than 15 dB shall be provided. A bit error rate of less than or equal to 1 in 10^{-9} shall be certified over the specified operating ranges.

As shown on the plans for field locations, the optical modems shall be installed as stand-alone units on a shelf. The DS-1 cables shall be connectorized as appropriate. The DS-1 modem shall be available in a stand-alone and rack-mount versions. The rack-mount card cage shall be capable of housing a minimum of seven modems in no more than 533 mm of vertical rack space. All hardware necessary for mounting both versions of the modem in a standard 482 mm rack shall be provided. The DS-1 optical modems shall operate from standard 60 Hz, 120 VAC power and operate as specified over the temperature range of 0°C to 50°C.

The optical receive power at each modem shall be measured and recorded before connection of the receive optical pigtail. The optical fibers shall be attached as required.

Fibers shall be tested as follows:

Each optical modem shall be functionally tested by looping back the optical transmit connector to the optical receive connector using a variable optical attenuator with measured optical loss of 10 dB at 1300 nm. A DS-1 test set shall be connected to the modem and set for ESF framing, B8ZS coding, internal timing, and a QRS pattern. The test set shall also be set for the standard DSX-1 output level and terminated input. A fifteen minute test after burn-in shall be error free.

After performing the fifteen minute bit error rate (BER) test, at least two modems shall be tested for receiver dynamic range. To do this the optical attenuation shall be increased to the point at which the data test just begins to register bit errors. The optical receive power into the modem shall be measured and recorded. The optical attenuation shall be then decreased until the data test once again registers errors. At no time shall the optical power into the receiver exceed the manufacturer's specified saturation level. The optical receive level shall once again be measured and recorded. These minimum and maximum receive levels define the modem receiver's dynamic range.

One pair of modems shall be interconnected using optical patchcords and attenuators with a loss of 10 dB in each direction. The DS-1 interface shall be looped back on one modem and a DS-1 test set connected to the DS-1 interface of the other modem. A bit error rate of less than 1 in 10^{-10} shall be demonstrated.

The following test sheet shall be filled out in the presence of the engineer.

APPENDIX C

Optical Modem Test Worksheet

Contract No. _____ Contractor: _____

Operator: _____ Date: _____

Location: _____

DS-1 Optical Modem, Modem No. :

Optical Receiver Power (max) into modem (10^9 BER) _____ dB 3A

Optical Receiver Level (minimum) into modem _____ dB 3B

Receiver Dynamic Range (3A-3B): _____ dB 3C

DS-1 Optical Modem, Modem No. :

Optical Receiver Power (max) into modem (10^9 BER) _____ dB 4A

Optical Receiver Level (minimum) into modem _____ dB 4B

Receiver Dynamic Range (4A-4B): _____ dB 4C

DS-1 Optical Modem, Modem No. :

Optical Receiver Power (max) into modem (10^9 BER) _____ dB 5A

Optical Receiver Level (minimum) into modem _____ dB 5B

Receiver Dynamic Range (5A-5B): _____ dB 5C

DS-1 Optical Modem, Modem No. :

Optical Receiver Power (max) into modem (10^9 BER) _____ dB 6A

Optical Receiver Level (minimum) into modem _____ dB 6B

Receiver Dynamic Range (6A-6B): _____ dB 6C

Payment.--Full compensation for furnishing all labor, materials, tools, equipment, and incidentals required to provide fully equipped and operating system, and for doing all the work involved in the data node shall be considered as included in the lump sum price paid for closed circuit television camera (Location GL031) and no additional compensation will be allowed therefor.

INTERFACE TO TRAFFIC ELEMENTS

The communication system shall interface to traffic elements as shown on the plans. These elements are the traffic monitoring stations. The following equipment shall be supplied by the Contractor at each of the new traffic elements including CCTV cameras:

FDU

Interface cable

Single fiber optic transceiver (transmitter) for CCTV camera locations.

The FDU and single fiber optic transceiver (transmitter) are specified elsewhere in these special provisions.

Interface Cable

Interface cable shall consist of six No. 22, stranded tinned copper conductors. Each conductor shall be insulated with 0.25 mm, minimum nominal thickness, color polypropylene material. Conductors shall be twisted pairs. Each pair shall be wrapped with an aluminum polyester shield and shall have a No. 22 or larger, stranded, tinned copper drain wire inside the shielded pair.

The cable jacket shall be polyvinyl chloride, rated for a minimum of 300 V and 60°C, and shall have a nominal wall thickness of one mm, minimum.

The cable shall be one meter long with a connector for termination to the Model 170 controller and a DB25 male termination to the fiber optic data modem.

The connector at the Model 170 controller shall meet the following requirements:

Amphenol or equivalent	
Part	Number
Shield	201378-2
Block	201298-1
Guide Pin	200390-4
Socket	200389-4

The cable shall have the following pin configuration:

Model 170 Controller	
Pin No.	Function
N	DC Ground
H	DCD
L	Rx Data
K	Tx Data
J	RTS
M	CTS

HIGHWAY ADVISORY RADIO SYSTEM

The highway advisory radio (HAR) system shall consist of AM broadcast band radio equipment for a fixed location.

The HAR system shall include one AM transmitter, coupler, audio processor, telephone line interface, solid-state recorder and player, one antenna, grounding system, transient lightning suppression, battery back-up and charging systems, external digital recorder and player microphone, (or broadcast quality headset with noise canceling microphone) and control speaker phone.

The outside of each equipment packing container shall be marked with the Caltrans contract number and the make, model number, serial number, and installed operating frequencies of the unit within.

Test methods followed by the State for evaluation of supplied equipment will follow EIA recommendations where applicable.

Prototype equipment is not acceptable. Only equipment previously manufactured and sold for at least 6 months prior to the advertising date will be acceptable.

Any semiconductor devices or components utilized in the radio equipment which are not available from a minimum of two manufacturers shall have five such devices or components provided for each device utilized in the radio equipment.

All manuals, warranties, and licenses shall be submitted with the unit(s) for acceptance.

All equipment shall be warranted against defects and any failures which may occur through normal use for one year from the date the equipment is placed in service.

Proper contact protection shall be placed at all high voltage connections to prevent accidental contact with operators and operator's tools and equipment.

The HAR system may consist of equipment from multiple manufacturers but shall be integrated to be fully functional.

The HAR system shall be designed to operate in conformance with CFR Title 47, Section 90.242 of the FCC rules and regulations.

Enclosures for all radio, electrical, and mechanical equipment shall be designed to be card rack mounted inside a Type 334-TV cabinet enclosure as specified in these special provisions. Card rack mountable equipment shall be provided with slotted mounting holes and shall be compatible with an EIA-310-D rack.

The equipment shall be designed and installed in such a way as to be easily accessible for maintenance.

Transmitters

The transmitters shall be the type accepted or type approved for travelers information stations (TIS) service and shall operate in a range of from 530 kHz to 1710 kHz.

Each transmitter shall have the capability of remote and local control. The ability to broadcast live messages from the transmitter site and the ability to record and broadcast from the Regional Transportation Management Center (RTMC) shall be provided.

Adjustment of RF power output shall be made by using an easily accessible control and shall be continuously adjustable over the transmitter output power range specified herein.

Built-in, switchable meter shall indicate relative percentage of modulation and forward and reflected RF output power levels.

A provision for automatic station identification using stored, digitized audio shall be provided every 30 minutes while transmitting.

Operating temperature range shall be from -30°C. to 60°C. Operating humidity range shall be from 20 percent relative at 30°C. to 95 percent relative at 50°C.

The HAR shall deliver a 2 mV per meter signal, minimum, at a distance of 1.5 km (0.93 miles) from the transmitter antenna with a maximum transmitter output of 10 W.

The transmitter shall withstand an overload mismatched output (including an open or short circuit) for a period of 5 minutes at 10 W output without overheating or component failure. The transmitter shall automatically resume normal operation when the mismatched output load is removed.

The transmitter RF power output level shall be rated at 30 W, maximum. The transmitter output level shall be adjusted from a minimum of 2 W to no more than 12 W. A warning label shall be securely attached to the transmitter next to the adjacent output control and shall read as follows, "DO NOT EXCEED 10 W".

The transmitter shall be equipped with a high stability oven controlled crystal oscillator. The oscillator shall be of the stress compensated (SC) cut crystal type and meet the following specifications:

Oscillator	
Temperature	+5 x 10 ⁻⁸ over -24°C. to 70°C.
Aging:	5 x 10 ⁻¹⁰ /day, 1 x 10 ⁻⁷ /year
Frequency vs. supply:	2 x 10 ⁻⁹ /percent
Short-term: (Allan Variance)	1 x 10 ⁻¹¹ /second
Warm-up @25°C.: (Relative to 2 hours after turn-on following 24 off)	1 x 10 ⁻⁷ in 7 minutes 3 x 10 ⁻⁸ in 10 minutes
Output:	>0.5V ^{RMS} into 50 (7 dBm)
Harmonics/subs:	-20 dBc (for sine out)
ssb Noise/Hz:(Typical, degrades 6 dB per octave above 12 MHz)	-115 dBc at 10 Hz -148 dBc at 10 kHz
Supply:	12 VDC + 5%
Input power:	<3.5 W at turn-on years <1.7 W stabilized at 25°C.
Frequency Adjust: (Mechanical)	Range for 10 years aging, settable to 5 x 10 ⁻⁹ nominal
Electrical tuning:	Not included
Size:	50 mm x 50 mm x 25 mm
Base:	Pins for PC Mounting

Transmitter Station.--The transmitter station shall include the amplitude modulation (AM) transmitter and antenna system, digital recorder system, lightning protection, controls, dual tone multi-frequency (DTMF) telephone handset, back-up system, conduit, wiring and other hardware required for proper operation. The transmitter station shall be housed in a Model 334 cabinet enclosure.

The operating frequency of the transmitter shall be determined by the states Engineer.

Coupler Unit.--The coupling unit shall:

- isolate the transmitter from high voltage through the use of high-pass capacitors and fuses.
- compensate for antenna system impedance mismatch through the use of multi-tap toroidal transformers.
- compensate for antenna stray reactance through the use of a decade system of capacitor combinations.
- include an internal voltage standing wave ratio (VSWR) meter and include controls for correcting load impedance and reactance.

HAR Power and Back-Up Equipment.--Equipment necessary for operation and backup of the HAR shall be included as part of the system and shall conform to the following.

Primary Power Input Provisions.--Operation shall be from 117 + 10 % VAC, 60 + 3 Hz single phase, at a power input not to exceed 100 W, continuous.

The primary input power shall be controlled by a circuit breaker mounted on the front panel labeled "AC POWER".

An AC power light indicator shall be provided on the front panel.

Main Power Back-up.--In the event of AC power loss, the HAR system shall automatically switch to a battery back-up system and continue to operate without degradation of performance for a period of not less than 12 hours.

The battery back-up system shall utilize a battery charger and gel cell batteries. The battery back-up system shall maintain the batteries without overcharging. The batteries shall not emit any corrosive, toxic or explosive gasses.

The HAR system shall resume normal operation after AC power has been restored.

Indicator lights shall be provided to show when the unit is operating on AC power, or when it is operating on battery back-up. A voltmeter shall show the condition of the battery back-up system.

A front panel switch labeled "DC POWER" shall activate DC operation for the HAR system.

Fuse protection shall be provided on the battery charger and on the front panel for DC load.

The battery charger shall be designed for floating service and have an adjustable output voltage. The battery charger shall be the complete shut off type (fully automatic) and shall bring completely discharged batteries to a fully charged condition within 12 hours. The battery charger shall be designed to operate in unventilated area.

When the HAR is operating on battery back-up, the system shall automatically disconnect the HAR, to protect the batteries from damage caused by too deep a discharge. The disconnect threshold shall be adjustable over the range of either 20.0 to 24.0 VDC for a 24 V system or 10 to 12 VDC for a 12 V system.

The batteries shall not discharge to less than 10 VDC for a 12 V system, or 20 VDC for a 24 V system, when supplying 4.0 A for a period of 30 hours at 30°C. They shall be organized as a group of two 12 volt batteries and mounted on a wooden frame at the bottom of the controller cabinet enclosure.

The batteries shall be easily accessible and removable from the cabinet for service or replacement using connectors that do not require the use of hand tools. If 2 connectors are identical, and used for different purposes, they shall be clearly marked or polarized differently to ensure proper installation after repair or replacement of component parts. When the battery back-up system is disconnected from the cabinet, the station shall be capable of continued operation solely on AC power without having to connect, jump, or bypass any other device. Only relay, contact, and switch type devices shall be used to make a clean procedure of removal.

HAR Operation Control Equipment

Equipment necessary for local and remote control of the HAR operations shall be included as part of the system and shall comply with the following:

Local Control Facilities.--Local operator control of all essential features of the highway advisory radio station shall be accomplished both by the use of a standard dual tone multi-frequency (DTMF) telephone and by necessary discrete front panel controls.

Remote Control Facilities.--A telephone line interface shall be provided (prior to cut-over) so that the HAR may be connected to and controlled through a voice-grade dial-up telephone line, leased telephone line, or cellular telephone line with appropriate interface. The telephone line interface shall have a standard RJ-11 connector.

The HAR Remote Control Facility shall be fully functional and operational when it is cut-over to the cable-based communications infrastructure. Remote access shall occur from the RTMC to the HAR transmitter via the cable-based communications infrastructure.

The HAR shall be equipped with a telephone line interface so that it will be possible to access, monitor, and control the message being transmitted. The audio for the monitor function shall be obtained by demodulating the transmitter audio.

HAR Message Storage and Management Equipment

Equipment necessary for storage and management of messages shall be included as part of the HAR and shall comply with the following:

Message Management.--The HAR shall be able to receive a live or recorded message from a remote location via the cable-based communication infrastructure telephone line, and cellular telephone line and from the operator at the station location. This feature shall not require the use of hand tools.

The message shall be stored in a solid-state recorder and player, with the ability for selecting and checking the message prior to transmission.

Solid State Recorder and Player.--Non-volatile solid-state memory shall be used for message storage. Magnetic media is not acceptable.

A DTMF decoder shall be provided for programming and control of the recorder using a standard DTMF telephone. This function shall be possible, both remotely, via the telephone line interface, and at the station location. The DTMF tones shall not be recorded on the message.

Memory storage capacity shall be provided for a minimum of 250 different messages, with a minimum of 860 seconds total recording time. The length of each message shall be continuously variable up to the total recording time available.

The recorder shall have the flexibility for messages to be selected and organized into a minimum of 20 different message play lists with a minimum total of 100 different messages contained within the 20 play lists.

An internal clock shall be provided to select and control message play-back by day, hour, and minute.

The system shall allow the recording of a message while another message is being broadcast.

Recording features shall include:

Monitor off-air RF output of transmitter.

Recording message.

Playback of recorded message.

Erasing of message.

Set time spacing between messages.

Set play list sequence.

Hear play list sequence.

Set recording source input (dynamic microphone, cassette player (auxiliary audio input), and control telephone).

Set recording speed.
Set background source materials message.
Set alternate audio source.
Set clock time and day of the week (clock time shall be in military time and day of week shall be from 1 to 7, where 1 is Sunday).
Set message schedules.
Hear message schedules.
Cancel message schedules.
Set play list number.
Hear play list number.
Cancel play list number.
Stop record.
Set remote record security code.

The functions of recording and editing shall be accessible remotely or locally.
The recorder shall be able to be configured in the message repeater mode using DTMF tones.
Frequency response shall be from 200 to 10,000 Hz.

Memory Power and Back-up.--The recorder shall operate on 24 VDC + 5 percent at a total power consumption not to exceed 10 W from the source. The recorder memory back-up shall operate on 8 to 24 VDC.

In the event of AC power loss to the digital recorder, the memory power back-up shall automatically maintain messages in the memory for up to two weeks.

HAR Transient and Lightning Protection

The transient and lightning (T/L) protection shall be provided for the power line, telephone line, and antenna system.
The T/L protection for the power line shall provide as a minimum protection the following:

Number of AC outlets (minimum)	5
Turn-on voltage:	200 V
Energy rating (minimum): IEEE 8/20 waveform	700 J
Peak Current (minimum)	20,000 A
Stand-by current (maximum), for 60 z:	1 mA

The T/L protection for the telephone line shall provide as a minimum protection the following:

Clamping voltage:	200 V + 10%
Energy rating (minimum)	400 J
Series resistance (max.):	30
Response time (maximum):	1 nanosecond

The T/L (lightning arrestor) protection for the antenna system shall provide as a minimum protection the following:

Clamping voltage:	90 V + 10%
RF power (minimum):	35 W
Frequency range:	500 kHz to 2 MHz
VSWR (maximum):	1.2 to 1
Insertion loss (maximum):	0.2 dB
Surge current (minimum): IEEE 8/20 waveform	17,000 A
Response time (maximum):	5 nanosecond

Antenna

The antenna shall be a center-loaded vertical whip type with loading coil.

The antenna shall be designed to be mounted on a fiberglass pole as shown on the plans. The length of the antenna shall be tuned for the selected frequency and shall not be less than 3.05 m and not more than 7.62 m. The top of the antenna shall extend 14.93 m above ground level.

The antenna shall be anodized aluminum with a tuning tip. The tip shall be adjustable for precise tuning and shall be made of stainless steel tubing Type 316, Heat 150907.

The antenna shall be the weather resistant type and shall operate within a temperature range of -40°C. to 85°C. It shall withstand wind velocities of 129 km per hour without any discernible damage while remaining functional.

The maximum weight of the complete antenna including lower base, loading coil form, mid tip pipe and adjustable stainless steel tip shall not exceed 5.4 kG. The lower base of the antenna shall be aluminum Type 6063-T832 with No. 215 R1 gold anodized finish.

The loading coil shall be a continuous filament glass fabric. Epoxy G-11 and the coil shall be made of enameled close wound copper wire.

The antenna mounts shall be the "high impact thermoplastic split" type and shall provide 360 degree support to the antenna. All other mounting hardware shall be stainless steel or cadmium-plated.

Attention is directed to the requirements for fiberglass highway advisory radio (HAR) standard, elsewhere in these special provisions.

Ground System

The ground system shall be the ground rod type as shown on the plans and described in these special provisions.

12 Meter Ground Rod.--The ground rod system shall consist of a 12 meter ground rod placed in a 150 mm minimum, vertically drilled hole. The hole shall be backfilled with bentonite slurry.

The ground rod shall be a UL listed ground electrode designed for the purpose. The Contractor shall provide the Engineer a certificate of compliance from the manufacturer in accordance with the provisions of Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for the ground rod and bentonite backfill material. The certificate of compliance shall be provided to the Engineer for approval, prior to ordering or shipping the material.

The ground rod shall be a 54 mm outside diameter hollow tube of Type K copper, with nominal 2.11 mm wall thickness, 12 m in length. A rod formed from two 6 m sections and joined with an outside threaded copper coupler will be acceptable. The top end of the rod shall have a shop welded ground connection with a 4/0 gage, minimum, copper pigtail. The ends of the rod shall have press-on end caps.

The breather and weep holes on the top and bottom of the rod, as shown on the plans, shall be protected with tape until the installation of the rod. The Contractor shall remove the tapes and provide them to the Engineer before installation.

The drilled hole shall be backfilled with 100 percent bentonite clay slurry and consolidated around the rod. The bentonite slurry shall be placed in the presence of the Engineer. Two working days notice shall be provided to the Engineer prior to backfilling.

The bentonite backfill material shall be a natural volcanic, non-corrosive form of bentonite clay grout. The backfill material shall be capable of absorbing 53 L of water per 22.68 kG to obtain an optimal 30 percent solids density. The pH value shall be 8-10 with maximum resistivity of 3 at 30 percent solids density.

The ground rod shall be connected to a surge arrestor ground lug. The ground wire splice to the pigtail shall be made by a UL listed exothermic (Cadweld, or similar) connection method. Soldering, brazing, or field welding will not be acceptable.

The ground rod shall be filled with non-hazardous Calsolyte to enhance grounding performance. The filler shall hygroscopically extract moisture from the air to activate the electrolytic process, improving ground performance. The ground rod system shall be 100 percent self activating and maintenance free.

No additions of chemicals or water solutions shall be required.

Protective Pull Box.--The protective pull box shall be made of reinforced concrete with lift holes and a vented cast iron grate cover to permit air circulation into the "breather" holes of the ground rod.

HAR Installation

HAR equipment shall be installed at the locations shown on the plans.

The installation shall be under the immediate supervision of a person holding a general class radio telephone operators license.

Service Manuals

The Contractor shall provide 2 service manuals which will contain the following described sections.

Introduction.--Each manual shall contain a general information section which shall include the following items:

- A list of applicable sub-assemblies that comprise the specified equipment.
- Overall description of the equipment design features, performance, and applications.
- Equipment specifications summary.
- Equipment installation instructions, if applicable.

Theory of Operation Section.--Each manual shall contain equipment theory of operation section which shall include the following items:

- Theory of operation of the standard equipment, with unique or unusual circuitry described in detail.
- Theory of operation reflecting any modifications to the standard equipment.

Maintenance Section.--Each manual shall contain an equipment maintenance section which shall include the following items:

- Recommended test equipment and fixtures, or minimum operational and performance requirements for appropriate test equipment.
- Troubleshooting information and charts.
- Removal and installation procedures for replacing assemblies and subassemblies, if not obvious or if improper sequencing of steps may result in component damage.
- Component level circuit schematics of each circuit board, assembly and sub-assembly units depicting waveforms, AC and DC voltage levels and recommended adjustments for peak equipment performance.

Replacement Parts Section.--Each manual shall contain an equipment replacement parts section which shall include a component parts list(s) including electrical parts, mechanical parts, and assemblies. All semiconductors shall be identified by the supplier's numbers and, as applicable, by JEDEC numbers.

Diagram Section.--Each manual shall contain an equipment diagram section which shall include the following items:

- Schematic diagram(s) identifying all circuit components and showing normal test voltages and levels.
- An overall functional block diagram.
- Detailed interconnecting diagram(s) showing wiring between modules, circuit boards, and major components.
- Pictorial circuit board layout diagram(s) showing both component placement and printed wiring detail.
- Diagram(s) showing location of circuit boards and other subassemblies.
- Exploded view diagram(s) of complex mechanical assemblies.

Physical Requirements.--Each manual shall conform to the following physical requirements:

- All pages, including latest revisions, shall be securely fastened together between protective covers (loose-leaf ring binding is acceptable).
- No page shall be subject to fading from exposure to any normal source of ambient lighting (ozalid reproduced pages are not acceptable).
- The cover or first pages shall be marked in any manner to show the Caltrans Contract number and advertising and bid opening dates.

Arrestor Enclosure

The arrestor enclosure shall be a NEMA Type 3R with hinged cover, with dimensions of 381 mm x 305 mm x 152 mm and shall have provisions for padlocking. A 102 mm x 102 mm x 3 mm and/or 203 mm x 102 mm x 3 mm aluminum plate shall be installed vertically, facing the door, in the enclosure. The Contractor shall terminate the ground conductor(s) with an aluminum-copper NEMA one and/or three bolt hold tongue. The ground conductor(s) and lightning arrestor shall be mounted on the aluminum plate.

Antenna Coaxial Cable (ACC).--Type ACC shall consist of an RG-8/U single foil single braid flexible coaxial cable with a bare copper center conductor, Cellular Polyethylene dielectric, 97 percent tinned copper braid, and 100 percent shield coverage and shall conform to the following requirements:

Electrical Characteristics	
Capacitance	26 pF/0.305 m (nominal)
Impedance	50 (nominal)
Velocity of propagation	78% (nominal)
DC loop resistance	1.2 per 0.305 m (nominal) @20°C.

Attenuation at 20°C.	
Frequency (MHz)	Nominal dB/30.5 m
10.0	0.50
50.0	1.2
100.0	1.6
200.0	2.4

Physical Dimensions	
	Nominal O.D. (mm)
Center conductor	2.6
Dielectric	7.2
Outer jacket	10.3

Electrical Characteristics	
Impedance:	50 (nominal)
Frequency range:	0 -300 MHz
Voltage rating:	500 V peak

Mechanical Characteristics	
Mating:	Standard Size: 5/4-24 threaded coupling. Push-on mates with any standard size threaded receptacle.
Method of attachment:	Clamp and Crimp.
Composition:	Bodies-Brass or die cast zinc Contacts-brass, silver plated Insulators-TFC, copolymer of styrene, polystyrene, mica-filled phenolic and/or, PBT polyester or equal Plating-ASTRO plate and silver. Other metal parts-Brass.

Environmental Characteristics	
Temperature	-55°C to + 165°C
Moisture	Weather resistant design.

Antenna Feeding Cable (AFC)

The AFC shall consist of a No. 12 AWG solid copper conductor. The AFC shall have a length necessary to connect the lightning arrestor and the antenna without causing stress to the cable and shall be terminated with a UG plug and a reducing adapter as specified elsewhere in these special provisions.

After installing the AFC between the arrestor enclosure and the antenna, the Contractor shall seal the 38.1 mm nipple near the top of the fiberglass pole.

Coaxial Cable Connectors (For Type ACC and AFC)

Coaxial cable connectors for attaching Type ACC and AFC including the reducing adapter shall be UG Standard and meet the following requirements:

System Testing

Ground System Testing.--The Contractor shall take certified measurements before and after the installation of the ground system.

The testing shall utilize an earth resistance meter and be conducted in accordance with IEEE Standard 3-point fall of potential methods.

The Contractor shall provide all test equipment and take and document resistivity measurements on the grounding system as specified elsewhere in these special provisions and submit them to the Engineer for approval.

Cable Testing.--The antenna coaxial cable (ACC) will be tested by the Engineer. Those cables found to have faults shall be replaced. The testing will utilize a time domain reflectometer.

A fault in a length of cable is defined as any of the following:

1. A return loss measurement indicating that there is a short in the cable.
2. A return loss measurement indicating a cut or open circuit in the cable.
3. A visual inspection which reveals exposure or damage to the cable shielding.

HAR Testing.--After all HAR equipment has been installed, the Contractor shall test the HAR.

Minimum test equipment required for testing the HAR shall consist of:

1. Dummy load, 50 .
2. Power meter.
3. Communications monitor.
4. Field strength meter.

The Contractor shall tune the HAR with the impedance matching network of the coupling unit by adjusting the stainless steep tip of the antenna.

The HAR shall be considered tuned when the system's voltage standing wave ratio (VSWR) is at the lowest possible value as directed by the Engineer.

After the HAR has been tuned, the Contractor shall record and transmit a test message with the output power level of the transmitter set at approximate 10 W or lower. Modulation shall be adjusted between 85 to 95 percent as specified by the FCC for the standard AM broadcast band.

The Contractor shall make actual on-the-air field strength measurements. A sufficient number of points shall be selected in order to determine the distance at which the attenuated field of 2 mV/m exists, as measured with a calibrated standard field strength meter. This may be done in a 5 to 8 radial directions facilitating a plot of a 2 mV/m at a distance of 1.5 km from the HAR antenna. If the measured field exceeds 2 mV/m at a distance of 1.5 km, the transmitter output power shall be decreased accordingly and if the measured field is less than 2 mV/m at the same distance then the power may be increased as directed by the Engineer. This test sequence shall be executed for both daytime operations and nighttime operations.

At the completion of all HAR testing, the Contractor shall submit a written report of all measurements to the Engineer for approval. The report shall include a map, with scale, showing a 2 mV/m contour based on the actual on-the-air field strength measurements. The VSWR, percent modulation, and transmitter output power measurements shall be tabulated.

Full compensation for the technician from the manufacturer shall be considered as included in the contract price paid for the items involved and no additional compensation will be allowed.

HIGHWAY ADVISORY RADIO FLASHING BEACON AND SIGN

The highway advisory radio (HAR) flashing beacon and sign shall consist of a sign panel with two wood posts (reference to Standard Plan RS 3), two flashing beacons, power supply, control and communications equipment, controller box, mounting brackets, conduit and other hardware as shown on the plans, and shall function in concert with a HAR transmitter. The HAR Flashing Beacon and Sign shall conform to the following specifications:

Flashing Beacons. - Each flashing beacon shall consist of a single section traffic signal face, conforming to the provisions in Section 86-4.01 of the Standard Specifications, "Vehicle Signal Faces," with a solid yellow lens of 305 mm diameter.

Backplates. - Each beacon shall be provided with a backplate conforming to the requirements in Section 86-4.03, "Backplates," of the Standard Specifications.

Visors. - Each flashing beacon shall be provided with a full circular type visor conforming to the requirements in Section 86-4.01D, "Visors" of the Standard Specifications.

Control and Communications Equipment.-- Each flashing beacon control and communication assembly shall consist of switches, circuit breakers, flasher, dimming relay, AM radio antenna, AM radio receiver, control circuitry consisting of an 8-sequence dual tone multifrequency (DTMF) decoder, diode, wiring and electrical components necessary to provide proper operation of the flashing beacons; all housed in a single enclosure.

The AM radio receiver shall conform to the following parameters:

- Superhetrodyne
- Four intermediate frequency (IF) tuned circuits
- Vernier mechanical tuning: from 530 kHz to 1710 kHz, shall maintain tuned frequency during a loss of electrical power.
- Internal ferrite rod antenna for the reception of the AM transmission in the frequency range from 530 kHz to 1710 kHz, shall include external antenna connections.
- Switchable wide/narrow band reception selection for improvement of fidelity.
- AM radio receiver shall operate from a standard 120 VAC, 60 Hz (+/- 3 Hz) single phase commercial electrical power source.
- Swivel mounted exterior vertical whip antenna, attached to cabinet exterior, suitable for the reception of an AM transmission in the frequency range from 530 kHz to 1710 kHz.

The control circuitry shall conform to the following parameter:

- The control circuitry shall provide a DTMF circuit that will support four digit turn-on sequences, four digit turn-off sequences, and shall operate continuously on-line.
- The control circuitry shall provide a minimum of 64 turn-on sequences and 64 turn-off sequences, and shall operate continuously on-line.
- The control circuit tone sequencer shall have a user-selectable time period of up to 15 minutes maximum. Electrical power to the relay shall be removed if no tone sequences are received from the control circuit within the 15 minute time period.

Proper operation of the HAR flashing beacon and sign shall include, but not be limited to, utilizing the AM transmission frequency to turn on and off the flashing beacons. This operation shall be achieved by transmitting a DTMF signal over the HAR AM transmission at a specified frequency as shown in the Plans. The AM radio receiver shall receive the AM transmission while the 8-sequence DTMF decoder shall decode the appropriate tone sequence to enable a turn-on or turn-off of the HAR flashing beacon assembly as shown in the plans.

Enclosure. - The enclosure shall be NEMA Type 3R, and shall be provided with a dead front panel and a hasp to permit padlocking of the cover. The padlock will be furnished by others.

The enclosure shall be hot-dip galvanized or, at the option of the Contractor, shall be provided with a factory applied rust resistant prime coat and finish coat.

Circuit Breakers and Switches. - A 15 A circuit breaker shall be installed to protect the electrical circuits associated with each electrical cable entering the enclosure that provides a commercial electrical power feed.

A switch to permit manual operation of the sign lighting circuit shall be provided. Switches shall be of the single-hole-mounting toggle type, single-pole, single throw, rated at 12 A, 120 V. Switches shall be furnished with a toggle position nameplate reading "Auto - Test" and shall be connected in parallel with the load contacts of the photoelectric control circuit. A 15 circuit breaker may be substituted for the toggle switch.

Flasher. - The flasher device shall conform to the requirements in Section 86-3.08L, "Flasher" of the Standard Specifications. The flasher shall provide 50 to 60 flashes per minute with 250 to 350 milliseconds of dwell time.

Wiring. - Conductors and wiring in the enclosures shall conform to the requirements in Section 86-3.07, "Controller Cabinet" of the Standard Specifications and as set forth in the Plans.

Dimming Relay. - A dimming relay shall be provided to reduce the voltage to the 1 A at night. Dimming relays shall conform to the requirements in Section 86-3.09B, "Heavy Duty Relays" of the Standard Specifications.

Primary Input Power. - Electrical power to the flashing beacon equipment shall be provided from a 120 VAC, 60 Hz + 3 Hz single phase, continuous source. The primary input power shall be controlled by a circuit breaker mounted on the front panel labeled "AC POWER." An AC power light indicator shall be provided on the front panel.

Sign Panel Mounting. - The sign panel to be installed on flashing beacons shall be mounted using galvanized commercial quality 7.95 mm diameter hexagonal head bolts and nuts, galvanized flat washers and lock washers with a fiber washer contacting the face of the sign panel.

Sign Panels. - The sign panels shall be side-mounted or rigid mounted in a frame, with white legend, symbols, arrows and border on each face, as shown on the Plans. The background shall be blue as indicated in the Plans.

System Test of HAR Flashing Beacon.- Contractor shall perform a system test of the HAR Flashing Beacon device and shall conform to the following parameters:

Verify and record all DC and AC voltages of the HAR Flashing Beacon device prior to commencement of systems level test sequence.

Turn HAR Flashing Beacon on and off manually, perform this test sequence at least ten times leaving beacon "On" for a minimum period of five minutes each time and turning the beacon "Off" for a minimum period of 30 minutes each time. Verify beacon device is flashing at one second intervals during the "On" time test sequence. Verify beacon is off (not flashing) during the 30 minute test sequence. Repeat the above test for both daylight operations and night operations.

The following test shall be performed in concert with the HAR transmitter by generating a DTMF tone sequence to turn-on the HAR Flashing Beacon and to turn-off the HAR Flashing Beacon. This shall be accomplished through the AM transmission of the HAR transmitter, the AM transmission shall be at an operating frequency as shown on the Plans.

The following test sequence shall also be executed from the Regional Traffic Management Center (RTMC) when the HAR Flashing Beacon is cut-over to the cable-based communications infrastructure.

Turn HAR Flashing Beacon on and off remotely (automatically), perform this test sequence at least ten times leaving beacon on for a period of five minutes and turning the beacon off for a period of 30 minutes as set forth in paragraph 14.2 above. Verify beacon device is flashing at one second intervals during the "On" time test sequence.

Verify beacon is off (not flashing) during the 30 minute test sequence. Repeat the above test for both daylight operations and night operations.

Record all tests performed at each HAR Flashing Beacon location and submit the finalized recorded test data to the state's Engineer.

10-3.26 COMMUNICATIONS SYSTEM CUTOVER

Communications system cutover is the orderly disconnection of existing communications facilities and the connection, activation, testing and placing into operation the new communications system. Communication cutover shall consist of the installation of new individual field sites of communications equipment. The integration and testing shall begin at the site of the fiber optic communications system with control from the RTMC building (Route 2 / Route 134 separation).

To minimize downtime of the system, cutover of field sites shall begin after the following tasks have been performed:

1. Perform pre-installation tests on all new equipment.
2. Install and test the entire project cable plant.
3. Install all telephone bridges and 12 pair terminal blocks at all controller cabinets where required. Install all termination equipment in the RTMC building
4. Test fiber optic cable links from the individual video/data nodes to the RTMC building.
5. Perform subsystem testing on all channel cards, data links, video links and multiplexed video links.

All testing listed above shall be performed as described in "System Testing and Documentation," elsewhere in these special provisions.

Cutover of individual field sites shall be performed in the following sequence:

1. Route 2: new data node, new cable node and new video node from KP 23.9 to KP37.2
2. All CCTV sites in this project.
3. All other ramp meter, HAR Transmitter, HAR Flashing Beacon and surveillance sites.

The cutover of all CMS, ramp meter and traffic monitoring (count) station sites shall follow the cutover plan, detailed on the Route 2 Schematic sheet as shown in the plans, on a circuit basis. No new cutover shall begin until the previous circuit cutover is completed.

The Contractor shall provide a detailed Cutover Plan to the Engineer for approval, at least 30 working days prior to the beginning of communications system cutover. The Cutover Plan shall be designed to minimize the downtime of each field site. The Contractor shall coordinate all cutover activity with the Engineer.

Except as otherwise provided in these special provisions, communications with CMS and ramp metering and traffic monitoring (count) station controllers shall be interrupted only during the hours specified and under the restrictions listed below for each individual system.

RAMP METERING AND TRAFFIC MONITORING (COUNT) CONTROLLER RESTRICTIONS

The Contractor shall carry out ramp metering and traffic monitoring (count) station controller cutover subject to the following restrictions:

No more than five individual Model 170 controller locations, each with its own unique controller ID number, as indicated on the plans, shall be subject to disruption at any time during the system cutover.

No ramp metering or traffic monitoring (count) station controller shall be disconnected or disrupted between the hours of 6:00 a.m. and 9:00 a.m., and from 3:00 p.m. to 7:00 p.m., Monday through Friday.

No ramp metering or traffic monitoring (count) station controller shall be disconnected from its electrical power source for more than 15 minutes in any 24 hour period without prior written approval from the Engineer.

The Contractor shall obtain written approval from the Engineer, not less than two working days prior to any testing, disconnection or disruption of services, from any ramp metering and surveillance controller site.

Full compensation for the communications system cutover, shall be considered as included in the contract lump sum price paid for system testing and documentation, and no separate payment will be made therefor.

10-3.27 TRAINING

MAINTENANCE TRAINING

The Contractor shall provide a maintenance training course on the proper operation and maintenance of the equipment under this contract. The course shall be designed specifically on the final configuration of the system reference material from the operation and maintenance manual. A training area will be provided by the State at the District Office Building at 120 South Spring Street, Los Angeles, California. The Contractor may, at his option, provide the training at his plant or office if it is located within reasonable travel distance (approximately one hour travel time) from the district office.

The maintenance course shall provide training for technical personnel, competent and proficient in the English language, and shall follow a training outline prepared by the Contractor. The Contractor shall provide all materials and instructors for the maintenance course. The course shall be not less than two eight-hour (excluding lunch and breaks) days in duration. No more than fifteen State employees with technical backgrounds will attend this course. Each person shall receive a training manual. The training manual shall be written especially for the Route 2 Freeway CCTV and Communications System and shall provide complete procedures for operating, maintaining, and trouble-shooting the cable plant, camera site equipment, and communications node equipment. The maintenance section of the training course shall cover preventive, routine and emergency maintenance procedures. The emergency maintenance discussion shall provide recommendations for the provisioning and use of emergency repair kits to assist maintenance crews.

The maintenance course shall also include "hands on" field training using operational equipment at the communications building and at one of the camera sites. The field training shall include the operational checkout of a camera site and shall discuss the location of and access to the various system field elements.

The information for this course shall be separated into appropriately titled sections such as:

- A. System Design
- B. Hardware
- C. Software
- D. Operation
- E. Maintenance
- F. Operating System

All manuals provided for this course shall be collected at the completion of each course by the Instructor and delivered to the Engineer for later distribution to State personnel. The Contractor shall provide an evaluation sheet to be completed by the attendees. The evaluation sheets will be turned in to the Engineer and a copy will be provided to the Contractor. The evaluations sheets need not be signed by the attendees.

One copy of the manual for this course shall be delivered to the Engineer for approval at least 8 weeks prior to the scheduled class time. The Engineer will notify the Contractor of the number of State personnel who will attend. The maintenance course must be completed prior to the acceptance of the contract.

OPERATIONS TRAINING

The Contractor shall provide a operations training course on the proper operation of the equipment under this contract to the State personnel. The course shall be designed specifically on the final configuration of the system reference material from the operation and maintenance manual. The training shall provide "hands on" with the installed equipment and systems in the RTMC building located at the Route 2 / Route 134.

The training course shall be held after the system has been installed and accepted. The courses shall be developed specifically for the system and shall assume minimal prior knowledge of closed circuit television camera technology. No more than fifteen State employees will attend this course.

Instructors shall be technically knowledgeable, competent and proficient in the English language. A member of the Contractor's staff with intimate experience with this contract shall attend the courses and provide answers to any inquiries.

A draft of the course material shall be provided by the Contractor to the Engineer for approval in advance of the proposed course date. The Engineer will approve or reject the course material or content within three weeks of receipt. The Contractor shall allow adequate time for reviews and revisions to ensure the courses are held within the designated dates.

An overview and introductory level briefing shall be included to familiarize attendees with the CCTV subsystem. The course shall also include an overview of subsystem elements, operating procedures and capabilities and shall demonstrate new technology developments and improvements to our current communication practices as applied to our field elements.

Full compensation for maintenance training and operations training shall be considered as included in the contract lump sum price paid for system testing and documentation, and no separate payment will be made therefor.

10-3.28 SYSTEM TESTING AND DOCUMENTATION

The system testing and documentation shall cover pre-installation testing, sub-system testing, fiber optic cable testing, video link testing, acceptance testing, physical inspection, functional testing, performance testing, final acceptance and system documentation that is required to validate the operational performance of the communications system and described elsewhere in these special provisions.

Test Plan

The Contractor shall develop and submit within 60 working days to the Engineer an installation and test plan for approval, which details the method of installation and all testing for all material, equipment, and cable and the associated schedule of activities, based on these special provisions, plans, the manufacturer's recommended test procedures, and industry standard practices. Five copies of the test plan shall be submitted to the Engineer for approval. The Engineer will review then approve or disapprove the plan within four weeks. If the Engineer rejects the test plan the Contractor shall submit a revised test plan within 20 working days for review and approval by the Engineer. No testing shall be performed until the Contractor's test plan has been approved by the Engineer. The tests shall demonstrate that the design and production of material and equipment meet the requirements of these special provisions and plans. All test results, including results of failed test or re-tests, shall be submitted and delivered to the Engineer and a copy placed with the equipment at the site. All test equipment shall be supplied by the Contractor.

The Contractor shall notify the Engineer of his intent to proceed with functional and sub-system testing 48 hours prior to commencement of each test. Full environmental conditions shall be tested as part of the functional tests for field equipment. Sub-system testing and inspections shall include visual inspection for damaged in correct installation, adjustments and alignment, and measurement of parameters and operating conditions.

Pre-Installation Testing.--Pre-installation testing shall include testing of all material, equipment and cable in a laboratory environment prior to delivery to the site. Use of laboratory facilities, including an environmental simulation chamber, shall be arranged by the Contractor. The tests shall either be conducted at the equipment manufacturer's premises or at a laboratory arranged by the Contractor.

All material, except test equipment and special tools, shall be bench tested in accordance with the following paragraphs, which include those items described elsewhere requiring pre-installation testing for each individual item where applicable.

All active equipment shall be connected to normal operating power, energized and subjected to normal operating conditions for a continuous period of time in the laboratory of not less than 48 hours.

Functional testing shall be performed by the manufacturer on all material prior to delivery to the site. The functional tests shall be performed in accordance with an approved test plan. Any material or equipment which fails to meet the requirements of the contract shall be repaired or replaced and the test shall be repeated until satisfactory. All functional test results, including results of failed tests or re-tests, shall be submitted and delivered with all material and equipment delivered to the site.

Full performance test shall be performed by the manufacturer or by the Contractor on not less than 5 percent or at least one unit of material selected at random from the normal production run. The full performance test shall be performed in accordance with a test plan developed by the Contractor and approved by the Engineer.

Sub-system Testing.--Sub-system testing shall encompass the testing of all material, equipment and cable after installation, but prior to acceptance tests. These tests shall be done in accordance with the performance testing called under each individual item in these special provisions.

Equipment and hardware shall be installed in accordance with the plans and special provisions. All material, equipment and cable shall be tested after installation at the site. Sub-system testing and inspections shall include visual inspection for damaged or incorrect installation, adjustments and alignment, and measurement of parameters and operating conditions. The Contractor shall notify the Engineer of his intent to proceed with sub-system testing 48 hours prior to commencement of each test.

Installation documentation and test results shall be provided for all material, equipment and cable prior to commencement of acceptance tests. Installation documentation shall be in accordance with these special provisions and shall include the following as appropriate:

- Model, part number and serial number for all material and equipment.
- Test equipment model number, serial number, settings, and date of last calibration.
- All strap and switch settings.
- Record of all adjustments and levels.
- Alignment measurements.
- Identification of interconnections.
- All factory, laboratory and site test results.

Fiber Optic Cable Testing.--Attention is directed to "Fiber Optic Testing" elsewhere in these special provisions.

Video Link Testing.--The video link testing shall be conducted after the Contractor submits a test plan and receives approval from the Engineer, based on these special provisions, plans and the manufacture's recommended test procedures for the equipment involved. Measurements shall be made from the baseband - in to baseband-out connections. A video communications link shall include a single fiber optic video transceiver (transmitter), a single fiber optic video transceiver (receiver), interconnecting optical fiber, connectors and power supplies. The video link is to provide point-to-point transmission and reception of a full motion NTSC baseband video signal using an optical fiber as the transmission medium. Video system performance tests for any particular video link shall be performed after the associated camera has been installed and tested.

Each video link in the communications system shall be tested with a video test signal at the single fiber optic video transceiver (transmitter) input. The Contractor shall perform all level adjustments and alignments required on the video link in order for it to operate in accordance with these special provisions. If any video link fails to meet the performance requirements, the Contractor shall take all steps necessary to restore the failed link to the required performance.

Each video link in the communications system shall be tested for qualitative performance with its associated camera turned on and connected to the BNC connector of the video link transceiver (transmitter). The Contractor shall measure and record the received optical power at the optical connector of the single fiber optic video transceiver (receiver) from the single fiber optic video transceiver (transmitter) under test using a 90 percent APL (average picture level) flat field input to the transmitter. The Contractor shall measure, record and tabulate a single fiber optic video transceiver's (receiver) dynamic range at the optical connector of the single fiber optic video transceiver (receiver) from the video transmitter under test using a 90 percent APL (average picture level) flat field input to the single fiber optic video transceiver (transmitter). To do this the measured optical attenuation of the fiber being used shall be increased to the point at which the video test set just begins to show a 3 dB degradation of the video signal to noise ratio in accordance with EIA 250 video test procedures. The optical receive power into the single fiber optic video transceiver (receiver) shall be measured and recorded. Then the optical attenuation shall be decreased until the video test set once again shows degradation of the video and registers errors. At no time shall the optical power into the receiver exceed the manufacturer's specified saturation level. The optical receive level shall once again be measured and recorded. These minimum and maximum receive levels define the single fiber optic video transceiver (receiver)'s dynamic range and shall meet or exceed the specifications as specified elsewhere under these special provisions. This measurement shall be repeated for each video link. The video test set shall be approved by the Engineer. The Contractor shall measure and record the baseband video output level from the single fiber optic video transceiver (receiver) under test. This measurement shall be repeated for each video link.

The output video signal shall be connected to a video display monitor. The observed picture on the video display monitor shall be assessed for qualitative performance. All qualitative comments shall be recorded for each camera. The Contractor shall measure, record and tabulate the single fiber optic video transceiver's (receiver) dynamic range at the optical connector of the video demultiplexer's single fiber optic video transceiver (receiver) from the video multiplexer's single fiber optic video transceiver (transmitter) under test. To do this the measured optical attenuation of the fiber being used shall be increased to the point at which the video test set just begins to show a 3 dB degradation of the video signal to noise ratio in

accordance with EIA 250 video test procedures. The optical receive power into the single fiber optic video transceiver (receiver) shall be measured and recorded. Then the optical attenuation shall be decreased until the video test set once again shows degradation of the video and registers errors. At no time shall the optical power into the single fiber optic video transceiver (receiver) exceed the manufacturer's specified saturation level. The optical receive level shall once again be measured and recorded. These minimum and maximum receive level define the single fiber optic video transceiver (receiver)'s dynamic range and shall meet or exceed the specifications as specified elsewhere under these special provisions. This measurement shall be repeated for each video link. The video test set shall be approved by the Engineer. The Contractor shall measure, record and demonstrate that the performance meets or exceed the specified EIA RS-250 requirements listed below:

- Differential gain.
- Differential phase.
- Chrominance to luminance delay inequality.
- Amplitude vs. frequency characteristics.
- Frequency response characteristic.
- Signal to noise ratio.
- Signal to low frequency noise.
- Signal to periodic noise.
- Output signal level.

Channel Card Testing--The channel card testing shall be conducted after the Contractor submits a test plan and receives approval from the Engineer, based on these special provisions, plans and the manufacture's recommended test procedures for the equipment involved. The Contractor shall test all channel cards and record the results in accordance with the approved installation and test plan. The Contractor shall test DS1 optical modem and D4 channel banks at the RTMC building including all equipment located in the field, as specified elsewhere in these special provisions.

Channel card testing shall consist of functional and performance tests conducted between the D4 channel bank multiplex in the field and DS1 optical modems at the RTMC building and the D4 channel bank multiplex at the RTMC. The audio channel shall be verified in both directions using telephone instruments. The signaling system shall be verified in both directions. Circuits shall be fully tested to the channel card manufacturer's specification using a transmission impairment measuring set (TIMS).

Data link testing--The data link testing shall be conducted after the Contractor submits a test plan and receives approval from the Engineer, based on these special provisions, plans and the manufacture's recommended test procedures for the equipment involved. Data link testing is for the alignment and testing of the data system. The activities shall include verification of all data circuits in the low speed data links, high speed data ring network and in the integrated data system. The Contractor shall adjust levels required for the data system to operate.

Data link tests shall be conducted in two phases:

1. Channel card checkout.--Channel card checkout shall consist of functional tests conducted between the D4 channel bank multiplex at the data nodes and each system element as shown in the plans. The audio channel shall be verified in both directions using telephone instruments. The signaling system shall be verified in both directions. In addition for circuits using 4 WTO channel cards for modems, bit error rate (BER) tests shall be conducted using appropriate model 400, 1200 BPS modem or ITU compatible high speed modem, and a bit error rate test set (BERTS) shall be used to verify error free transmission for five minutes at the bit rate to be employed in the system.

2. Data link performance.--Data link performance tests shall be conducted between the D4 channel bank multiplex at the data nodes and each field cabinet location.

Records of all tests shall be delivered to the Engineer. Circuits shall be fully tested to the channel card manufacturer's. Modem manufacturer required channel specification shall be measured. In addition, end-to-end bit error rate tests (BERTS) shall be conducted using the type modem to be employed on the link at the bit rate to be employed. The bit error rate tests (BERTS shall be with the modem at the equipment site(s) configured in a loop back-and with the test setup at the node. BER tests shall be a minimum of 3 hours for each circuit exactly and fully configured for operation in accordance with these Special Provisions and the Plans including required bridges.

All circuits shall provide an error rate less than 1×10^{-6} .

Acceptance Testing--The acceptance testing shall be conducted in accordance with the approved test plan. The acceptance testing shall include conducting acceptance tests and subsequent retest, and documentation of the test results.

Final acceptance tests shall be conducted after the site and sub-system test results have been reviewed and accepted by the Engineer. These tests include the complete system in normal operations. The test plan shall address the full testing requirements of the specifications. The test plan shall detail all tests to be performed, the test results which are expected and the test schedule. The acceptance test plan shall include the following major test and acceptance categories:

- Physical inspection.
- Functional tests.
- Performance tests.

The Contractor shall test the communications system according to the approved acceptance test plan and shall provide all test equipment, labor and ancillary items required to perform the testing. The test equipment shall be certified to be calibrated to the manufacturer's specifications. The model and part numbers and date of last calibration of all test equipment shall be included with the test results.

Acceptance testing shall not commence until all material required by these special provisions and plans are delivered, installed, and aligned and all production test and site test documentation and results have been approved by the Engineer.

All acceptance test results shall be fully documented and such documentation provided as a condition of acceptance.

Physical Inspection.--The Contractor shall provide documentation to prove delivery of all material, equipment, cable and documentation. If any material or documentation is outstanding or have been replaced under pre-acceptance warranty a physical inspection and documentation shall be provided for this material. The physical inspection shall consist of inspecting all installed material to ensure workmanship satisfies the specified requirements.

Functional Tests.--The Contractor shall test all system functions to demonstrate that all circuits (video, data, and voice), cameras, camera control and all equipment satisfies the functional requirements of the specifications.

This testing shall include subjective testing of each camera image and verification of camera control from the camera control receiver. The connectivity of each data channel shall be demonstrated. The Contractor shall document all functional test results. In the event that any aspect of the functional tests are determined by the Engineer to have failed, the Contractor all cease all acceptance testing and determine the cause of the failure and make repairs to the satisfaction of the Engineer. Acceptance testing shall, at the discretion of the Engineer, be repeated beginning from the start of functional tests.

Performance Tests.--The Contractor shall conduct operational performance tests on the following:

- All video links from the camera to the cable nodes.

- All data circuits operational from the data nodes and cable nodes to the system elements located in the field equipment.

Video tests shall satisfy the end-to-end performance requirements under normal operating conditions. Video tests shall be measured with the camera video output transmitting a video signal at the input of the video display monitors. The Contractor shall test the video sub-system and record the results.

The video signal to noise shall be measured according to EIA-250. The video signal to noise ratio shall be measured and recorded with both the camera providing the video input reference and with suitable video test equipment providing the video reference signal. When the source is the test equipment, the video signal to noise ratio shall be greater than 47 dB.

Adjustments shall be calculated to account for any deviation in output level of the camera resulting from the variable light conditions, the automatic iris and associated automatic gain control. The resulting video signal to noise ratio shall be recorded.

The video signal to low frequency noise ratio shall be measured according to EIA-250. The resulting video signal to low frequency noise ratio shall be greater than 39 dB. If an AGC circuit does not allow measurement as per EIA-250, the Contractor shall submit an alternative test plan for approval.

The video signal to periodic noise ratio shall be measured according to EIA-250. The resulting video signal to periodic noise ratio shall be greater than 52 dB.

Data tests shall be performed on all operational and voice data circuits using appropriate test equipment for the measurement of the following parameters:

End-to-end bit error rate tests shall be run from the data nodes and cable node to each remote drop of each data Circuit A data test set shall be used at both the cable node and the remote modems to insert an asynchronous pseudo-random pattern using 8 data bits, 1 start bit, 1 stop bit and even parity. The data test set at the remote modem must hold RTS high for the duration of the data test. The data rate of the test sets shall be set to rate as employed in the system.

A 15 minute test on each drop of each multipoint circuit shall be error free in both directions. One drop of each circuit as chosen by the Engineer shall be tested for 72 hours. The average bit error rate in both directions shall be less than 1×10^{-6} at 9600 bps.

The round-trip propagation delay for each model 170-based controller circuit shall be measured by using a loop back connector on the slave modem furthest from the master. The loop back connector shall connect pin 2 to 3, 8 to 4, and 6 to 20 of the DB-25 connector. A data test set capable of measuring delay shall be used at the data node. The test shall be repeated 3 times and the average value calculated.

Pulse-width distortion shall be defined as the difference between the data pulse width into a data channel port at the communications building port and the pulse width out of the EIA-232C port of an interconnected drop modem.

Distortion shall be tested between the cable node and the selected field modem for each data circuit. The signal shall not have a gross span-stop distortion greater than 20 percent at any data interface measured as per EIA-404-A.

If any circuit or element fails to satisfy the specified performance requirements the Contractor shall determine the cause and correct the failure to the satisfaction of the Engineer. The full performance tests shall be repeated under operating conditions as determined by the Engineer.

System Documentation

The Contractor shall submit a draft copy of all documentation for review and approval prior to production of documentation. The Engineer will review and approve or reject the draft documentation within four weeks of receipt.

The Contractor shall modify the documentation if required and submit provisional documentation. The Engineer will approve or reject the provisional documentation within three weeks of receipt. The Contractor shall arrange for re-submission in a timely manner to meet the schedule in the case that the documents are rejected.

Draft documentation shall be submitted eight weeks prior to the start of installation. The draft documentation shall show the general approach in preparing the final manuals.

Upon approval of the draft documentation provisional documentation shall be supplied three weeks prior to the start of site testing. The provisional documentation shall be of the same format as the final manuals but with temporary insertion for items which cannot be finalized until the system is completed tested and accepted. Final documentation shall be submitted no later than four weeks after completion of the acceptance tests and shall incorporate all comments made during the approval stages. The Contractor shall be responsible for all delay caused by non-compliance to the specified requirements.

Final documentation shall be approved prior to its production. ten copies of all final documents shall be delivered. The copies shall be 215 mm x 279 mm (8.5 x 11 inch) paper and bound in three-ring hard-covered binders complete with dividers. System documentation shall be arranged in an operation and maintenance (O & M) manual format providing all the information necessary to operate, maintain and repair the equipment and cable to the lowest module or component level. The operation and maintenance manual shall as a minimum consist of the following sub-section as described below:

Master Items Index.--This shall be the first section of the O & M manual. The section shall describe the purpose of each manual and brief description to the directory of the manual. It shall also reference equipment manuals as required for additional and support material.

System Description and Technical Data.--This section shall contain an overall description of the system and associated equipment and cables with illustrative block diagrams. This section shall identify all equipment and cables in the system stating the exact module and option number that are employed in the system. Technical data specification and settings for every type of equipment or cable shall be provided. Any modification that has been done on the equipment shall be clearly described.

Theory of Operation.--The manual shall contain a functional description of each element of the system, explaining how each function is being achieved separately and how each element works together to form the complete system.

Software Documentation.--Proper documentation for all software shall be provided. The software documentation shall include a clear description of the system's functionalities and specifications. Description on each software modules and programs shall be provided. The Contractor shall supply related programming and system user manuals, application and utilities software use manual and all associated proprietary software manuals. Software listing of all custom programs shall also be provided, as well as a copy of any software source code.

Operations.--The manual shall describe how to operate the system and each particular type of equipment and software. Equipment layout, layout of controls, displays, software operating procedures and all other information required to correctly operate the system and each functional unit shall be provided. Procedures shall also be provided for initial tune-up of the system and adjustment and checkout required to ensure that the system is functioning within the performance requirements. Warning of special procedures shall be given. The functions and setting of all parameters shall be explained.

Corrective Maintenance.--The manual shall include fault diagnostic and repair procedures to permit the location and correction of faults to the level of each replaceable module. Procedures shall include alignment and testing of the equipment following repair, the test equipment, tools, diagnostic software required and the test set up.

Preventative Maintenance.--The manual shall include procedures for preventative maintenance in order to maintain the performance parameters of the system, equipment and cables within the requirements of the specifications.

Parts List.--The manual shall include a list of all replaceable parts with exact parts description and number and a directory of recommended suppliers with correspondence address, telephone and fax numbers.

Test Results.--This section shall include a copy of the results for all the tests that have been conducted for the contract.

Manuals.--Twelve complete sets of operation and maintenance manuals shall be provided. The manuals shall, as a minimum, include the following:

- A. Complete and accurate Block Diagrams.
- B. Complete installation and turn-on procedures.
- C. Complete performance specifications (functional, electrical, mechanical, and environmental) identified by a universal part number such as JEDEC, RETMA, or EIA.
- D. Complete stage-by-stage explanation and trouble-shooting procedures.
- E. Complete stage-by-stage explanation of operation.

System schematic drawings shall be provided to identify the type of equipment at each location and the function of all equipment. The drawings shall also show how the system is interconnected. A comprehensive list of cabling and wiring shall be provided to clearly identify the interconnection and labeling of all equipment in the field.

Final Acceptance

The final acceptance of the system will not occur until all of the following conditions have been met as follows:

Physical, functional, and full performance acceptance tests have been completed and the results are approved by the Engineer.

All documentation has been completed and submitted to the Engineer.

All connections that were changed to perform acceptance tests are restored and tested.

10-3.29 PAYMENT

Full compensation for hauling and stockpiling electrical materials shall be considered as included in the contract price paid for the item requiring the material to be salvaged and no additional compensation will be allowed therefor.

The contract price paid per meter for conduit of various sizes, types and installation methods listed in the Engineer's Estimate, shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, for finding all edge drains in the path of conduit routing and for doing all the work involved in installing the conduit on the bridge structures (bridge-interior-attached) and other methods shown on the plans, complete in place, including all trenching and backfill material required and pull boxes not otherwise paid for, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract price paid per meter for Size 32 innerduct shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in Size 32 innerduct, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract unit price paid for pull boxes of the size and types listed in the Engineer's shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in the installation of pull boxes complete in place as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract unit price paid for splice vault shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in splice vault, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract unit price paid for terminal block shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in terminal block, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract unit price paid for telephone bridge shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in telephone bridge, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum prices paid for changeable message sign at various locations shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing changeable message signs, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract price paid per meter for detector loop cable shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in detector loop cable, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract prices paid per meter for fiber optic cable of the types and sizes listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in fiber optic cables complete in place, including fiber optic testing, fiber distribution unit marking and labeling fiber optic cable assemblies, break out cables, connectors, cable tray and splicing, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract unit price paid for fiber optic splice closure shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in fiber optic splice closures, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract price paid per linear meter for twisted pair cable of the sizes listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in twisted pair cables complete in place, including protected terminal blocks, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract unit price paid for twisted pair splice closure shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in twisted pair splice closures complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum price paid for closed circuit television camera at various locations shall include full compensation for furnishing all labor, materials, tools, equipment, wiring and incidentals, and for doing all the work involved in closed circuit television cameras, complete in place, including ancillary or incidental items required to provide fully equipped system and operating at each location, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for arranging for a qualified technician employed by the CCTV equipment manufacturer or his representative, for the purpose of system turn-on, shall be considered as included in the contract price paid for the items involved and no additional compensation will be allowed therefor.

The contract lump sum price paid for the highway advisory radio system shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in the installation of the highway advisory radio system, including installation of HAR sign Location 3, complete in place, including testing of the highway advisory radio system and the grounding system, and providing service manuals, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum prices paid for the highway advisory radio flashing beacon and Sign at various locations shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in the installation of the HAR Flashing Beacons and Signs, complete in place, including testing of the HAR Flashing Beacons and Signs, and providing service manuals, as shown on the Plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer. Full compensation for technical support from the manufacturer shall be considered as included in the contract prices paid for the various items of work involved and no additional compensation will be allowed therefor.

The contract lump sum prices paid for cable node and cable node (Location GL131) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in cable nodes, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for arranging for a qualified technician employed by the various communication equipment manufacturers or their representatives, for the purpose of system turn-on, shall be considered as included in the contract prices paid for the various items of work involved and no additional compensation will be allowed therefor.

The contract lump sum price paid for system testing and documentation shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in system testing and documentation, complete in place, including communication system cutover and training, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

SECTION 11. MODIFIED STANDARD SPECIFICATION SECTIONS

SECTION 11-1. (BLANK)

SECTION 11-2. PORTLAND CEMENT CONCRETE

11-2.01 GENERAL

Portland cement concrete shall conform to the provisions in this Section 11-2, "Portland Cement Concrete," and the section entitled "Portland Cement Concrete" in Section 8, "Materials," of these special provisions. Section 90, "Portland Cement Concrete," of the Standard Specifications is deleted. Section 90, "Portland Cement Concrete," of the Standard Specifications is amended to read as follows.

SECTION 90: PORTLAND CEMENT CONCRETE

90-1 GENERAL

90-1.01 DESCRIPTION

- Portland cement concrete shall be composed of cementitious material, fine aggregate, coarse aggregate, admixtures if used, and water, proportioned and mixed as specified in these specifications.
- The Contractor shall determine the mix proportions for all concrete except pavement concrete. The Engineer will determine the mix proportions for pavement concrete. Concrete for which the mix proportions are determined either by the Contractor or the Engineer shall conform to the requirements of this Section 90.
- Unless otherwise specified, cementitious material shall be a combination of cement and mineral admixture. Cementitious material shall be either:
 1. "Type IP (MS) Modified" cement; or
 2. A combination of "Type II Modified" portland cement and mineral admixture; or
 3. A combination of Type V portland cement and mineral admixture.
- Type III portland cement shall be used only as allowed in the special provisions or with the approval of the Engineer.
- Class 1 concrete shall contain not less than 400 kg of cementitious material per cubic meter.
- Class 2 concrete shall contain not less than 350 kg of cementitious material per cubic meter.
- Class 3 concrete shall contain not less than 300 kg of cementitious material per cubic meter.
- Class 4 concrete shall contain not less than 250 kg of cementitious material per cubic meter.
- Minor concrete shall contain not less than 325 kg of cementitious material per cubic meter unless otherwise specified in these specifications or the special provisions.
- Unless otherwise designated on the plans or specified in these specifications or the special provisions, the amount of cementitious material used per cubic meter of concrete in structures or portions of structures shall conform to the following:

Use	Cementitious Material Content (kg/m ³)
Concrete designated by compressive strength: Deck slabs and slab spans of bridges Roof sections of exposed top box culverts Other portions of structures	400 min., 475 max. 400 min., 475 max. 350 min., 475 max.
Concrete not designated by compressive strength: Deck slabs and slab spans of bridges Roof sections of exposed top box culverts Prestressed members Seal courses Other portions of structures	400 min. 400 min. 400 min. 400 min. 350 min.
Concrete for precast members	350 min., 550 max.

- Whenever the 28-day compressive strength shown on the plans is greater than 25 MPa, the concrete shall be designated by compressive strength. If the plans show a 28-day compressive strength that is 28 MPa or greater, an additional 14 days will be allowed to obtain the specified strength. The 28-day compressive strengths shown on the plans that are 25 MPa or less are shown for design information only and are not a requirement for acceptance of the concrete.
- Concrete designated by compressive strength shall be proportioned such that the concrete will attain the strength shown on the plans or specified in the special provisions.
- Before using concrete for which the mix proportions have been determined by the Contractor, or in advance of revising those mix proportions, the Contractor shall submit in writing to the Engineer a copy of the mix design.
- Compliance with cementitious material content requirements will be verified in conformance with procedures described in California Test 518 for cement content. For testing purposes, mineral admixture shall be considered to be cement. Batch proportions shall be adjusted as necessary to produce concrete having the specified cementitious material content.
- If any concrete has a cementitious material, portland cement, or mineral admixture content that is less than the minimum required, the concrete shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place and the Contractor shall pay to the State \$0.55 for each kilogram of cementitious material, portland cement, or mineral admixture that is less than the minimum required. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract. The deductions will not be made unless the difference between the contents required and those actually provided exceeds the batching tolerances permitted by Section 90-5, "Proportioning." No deductions will be made based on the results of California Test 518.
- The requirements of the preceding paragraph shall not apply to minor concrete or commercial quality concrete.

90-2 MATERIALS

90-2.01 CEMENT

- Unless otherwise specified, cement shall be either "Type IP (MS) Modified" cement, "Type II Modified" portland cement or Type V portland cement.
- "Type IP (MS) Modified" cement shall conform to the requirements for Type IP (MS) cement in ASTM Designation: C 595, and shall be comprised of an intimate and uniform blend of Type II cement and not more than 35 percent by mass of mineral admixture. The type and minimum amount of mineral admixture used in the manufacture of "Type IP (MS) Modified" cement shall be in conformance with the provisions in Section 90-4.08, "Required Use of Mineral Admixtures."
- "Type II Modified" portland cement shall conform to the requirements for Type II portland cement in ASTM Designation: C 150.
- In addition, "Type IP (MS) Modified" cement and "Type II Modified" portland cement shall conform to the following requirements:
 - A. The cement shall not contain more than 0.60 percent by mass of alkalis, calculated as the percentage of Na_2O plus 0.658 times the percentage of K_2O , when determined by either direct intensity flame photometry or by the atomic absorption method. The instrument and procedure used shall be qualified as to precision and accuracy in conformance with the requirements in ASTM Designation: C 114;
 - B. The autoclave expansion shall not exceed 0.50 percent; and
 - C. Mortar, containing the cement to be used and Ottawa sand, when tested in conformance with California Test 527, shall not expand in water more than 0.010 percent and shall not contract in air more than 0.048 percent, except that when cement is to be used for precast prestressed concrete piling, precast prestressed concrete members, or steam cured concrete products, the mortar shall not contract in air more than 0.053 percent.
- Type III and Type V portland cements shall conform to the requirements in ASTM Designation: C 150 and the additional requirements listed above for "Type II Modified" portland cement, except that when tested in conformance with California Test 527, mortar containing Type III portland cement shall not contract in air more than 0.075 percent.
- Cement used in the manufacture of cast-in-place concrete for exposed surfaces of like elements of a structure shall be from the same cement mill.
- Cement shall be protected from exposure to moisture until used. Sacked cement shall be piled to permit access for tally, inspection, and identification of each shipment.
- Adequate facilities shall be provided to assure that cement meeting the provisions specified in this Section 90-2.01 shall be kept separate from other cement in order to prevent any but the specified cement from entering the work. Safe and suitable facilities for sampling cement shall be provided at the weigh hopper or in the feed line immediately in advance of the hopper, in conformance with California Test 125.

- If cement is used prior to sampling and testing as provided in Section 6-1.07, "Certificates of Compliance," and the cement is delivered directly to the site of the work, the Certificate of Compliance shall be signed by the cement manufacturer or supplier of the cement. If the cement is used in ready-mixed concrete or in precast concrete products purchased as such by the Contractor, the Certificate of Compliance shall be signed by the manufacturer of the concrete or product.
- Cement furnished without a Certificate of Compliance shall not be used in the work until the Engineer has had sufficient time to make appropriate tests and has approved the cement for use.

90-2.02 AGGREGATES

- Aggregates shall be free from deleterious coatings, clay balls, roots, bark, sticks, rags, and other extraneous material.
- Natural aggregates shall be thoroughly and uniformly washed before use.
- The Contractor, at the Contractor's expense, shall provide safe and suitable facilities, including necessary splitting devices for obtaining samples of aggregates, in conformance with California Test 125.
- Aggregates shall be of such character that it will be possible to produce workable concrete within the limits of water content provided in Section 90-6.06, "Amount of Water and Penetration."
- Aggregates shall have not more than 10 percent loss when tested for soundness in conformance with the requirements in California Test 214. The soundness requirement for fine aggregate will be waived, provided that the durability index, D_r , of the fine aggregate is 60, or greater, when tested for durability in conformance with California Test 229.
- If the results of any one or more of the Cleanness Value, Sand Equivalent, or aggregate grading tests do not meet the requirements specified for "Operating Range" but all meet the "Contract Compliance" requirements, the placement of concrete shall be suspended at the completion of the current pour until tests or other information indicate that the next material to be used in the work will comply with the requirements specified for "Operating Range."
- If the results of either or both the Cleanness Value and coarse aggregate grading tests do not meet the requirements specified for "Contract Compliance," the concrete that is represented by the tests shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place, and the Contractor shall pay to the State \$4.60 per cubic meter for paving concrete and \$7.20 per cubic meter for all other concrete for the concrete represented by these tests and left in place. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract.
- If the results of either or both the Sand Equivalent and fine aggregate grading tests do not meet the requirements specified for "Contract Compliance," the concrete which is represented by the tests shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place, and the Contractor shall pay to the State \$4.60 per cubic meter for paving concrete and \$7.20 per cubic meter for all other concrete for the concrete represented by these tests and left in place. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract.
- The 2 preceding paragraphs apply individually to the "Contract Compliance" requirements for coarse aggregate and fine aggregate. When both coarse aggregate and fine aggregate do not conform to the "Contract Compliance" requirements, both paragraphs shall apply. The payments specified in those paragraphs shall be in addition to any payments made in conformance with the provisions in Section 90-1.01, "Description."
- No single Cleanness Value, Sand Equivalent or aggregate grading test shall represent more than 250 m³ of concrete or one day's pour, whichever is smaller.
- Aggregates specified for freeze-thaw resistance shall pass the freezing and thawing test, California Test 528.
- The Contractor shall notify the Engineer of the proposed source of freeze-thaw resistant concrete aggregates at least 4 months before intended use. Should the Contractor later propose a different source of concrete aggregates, the Contractor shall again notify the Engineer at least 4 months before intended use. Blending of fine or coarse aggregates from untested sources with acceptable aggregates will not be permitted. Provisions for the time of submission of samples as provided in Section 40-1.015, "Cement Content," are superseded by the foregoing.
- Concurrently with notification of proposed sources of freeze-thaw resistant concrete aggregates, the Contractor shall furnish samples in the quantity ordered by the Engineer. The samples shall be secured under the direct supervision of the Engineer. Samples from existing stockpiles of processed aggregate shall be taken from washed materials and shall be visibly damp. Samples from materials in place in a material source shall be taken at depths from the existing surface that will ensure the presence of the full quantity of ground water. Excavations for the purpose of securing samples shall be made to the full depth of intended source operations. Samples shall be protected against loss of contained water until they are delivered to the Engineer.
- The Engineer will waive the above freeze-thaw test and the 4-month advance notice, required in this Section, provided aggregates are to be obtained from sources that have previously passed this test and test results are currently applicable.
- No extension of contract time will be allowed for the time required to perform the freezing and thawing test.

- When the source of an aggregate is changed, except for pavement concrete, the Contractor shall adjust the mix proportions and submit in writing to the Engineer a copy of the mix design before using the aggregates. When the source of an aggregate is changed for pavement concrete, the Engineer shall be allowed sufficient time to adjust the mix, and the aggregates shall not be used until necessary adjustments are made.

90-2.02A Coarse Aggregate

- Coarse aggregate shall consist of gravel, crushed gravel, crushed rock, crushed air-cooled iron blast furnace slag or combinations thereof. Crushed air-cooled blast furnace slag shall not be used in reinforced or prestressed concrete.
- Coarse aggregate shall conform to the following quality requirements:

Tests	California Test	Requirements
Loss in Los Angeles Rattler (after 500 revolutions)	211	45% max.
Cleanness Value		
Operating Range	227	75 min.
Contract Compliance	227	71 min.

- In lieu of the above Cleanness Value requirements, a Cleanness Value "Operating Range" limit of 71, minimum, and a Cleanness Value "Contract Compliance" limit of 68, minimum, will be used to determine the acceptability of the coarse aggregate if the Contractor furnishes a Certificate of Compliance, as provided in Section 6-1.07, "Certificates of Compliance," certifying that:

- coarse aggregate sampled at the completion of processing at the aggregate production plant had a Cleanness Value of not less than 82 when tested by California Test 227; and
- prequalification tests performed in conformance with the requirements in California Test 549 indicated that the aggregate would develop a relative strength of not less than 95 percent and would have a relative shrinkage not greater than 105 percent, based on concrete.

90-2.02B Fine Aggregate

- Fine aggregate shall consist of natural sand, manufactured sand produced from larger aggregate or a combination thereof. Manufactured sand shall be well graded.
- Fine aggregate shall conform to the following quality requirements:

Test	California Test	Requirements
Organic Impurities	213	Satisfactory ^a
Mortar Strengths Relative to Ottawa Sand	515	95%, min.
Sand Equivalent:		
Operating Range	217	75, min.
Contract Compliance	217	71, min.

a Fine aggregate developing a color darker than the reference standard color solution may be accepted if it is determined by the Engineer, from mortar strength tests, that a darker color is acceptable.

- In lieu of the above Sand Equivalent requirements, a Sand Equivalent "Operating Range" limit of 71 minimum and a Sand Equivalent "Contract Compliance" limit of 68 minimum will be used to determine the acceptability of the fine aggregate if the Contractor furnishes a Certificate of Compliance, as provided in Section 6-1.07, "Certificates of Compliance," certifying that:

- fine aggregate sampled at the completion of processing at the aggregate production plant had a Sand Equivalent value of not less than 82 when tested by California Test 217; and
- prequalification tests performed in conformance with California Test 549 indicated that the aggregate would develop a relative strength of not less than 95 percent and would have a relative shrinkage not greater than 105 percent, based on concrete.

90-2.03 WATER

- In conventionally reinforced concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 1000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1300 parts per million of sulfates as SO₄, when tested in conformance with California Test 417. In prestressed concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 650 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1300 parts per million of sulfates as SO₄, when tested in conformance with California Test 417. In no case shall the water contain an amount of impurities that will cause either: 1) a change in the setting time of cement of more than 25 percent when tested in conformance with the requirements in ASTM Designation: C 191 or ASTM Designation: C 266 or 2) a reduction in the compressive strength of mortar at 14 days of more than 5 percent, when tested in conformance with the requirements in ASTM Designation: C 109, when compared to the results obtained with distilled water or deionized water, tested in conformance with the requirements in ASTM Designation: C 109.

- In non-reinforced concrete work, the water for curing, for washing aggregates and for mixing shall be free from oil and shall not contain more than 2000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, or more than 1500 parts per million of sulfates as SO₄, when tested in conformance with California Test 417.

- In addition to the above provisions, water for curing concrete shall not contain impurities in a sufficient amount to cause discoloration of the concrete or produce etching of the surface.

- Water reclaimed from mixer wash-out operations may be used in mixing concrete. The water shall not contain coloring agents or more than 300 parts per million of alkalis (Na₂O + 0.658 K₂O) as determined on the filtrate. The specific gravity of the water shall not exceed 1.03 and shall not vary more than ±0.010 during a day's operations.

90-2.04 ADMIXTURE MATERIALS

- Admixture materials shall conform to the requirements in the following ASTM Designations:

- A. Chemical Admixtures—ASTM Designation: C 494.

- B. Air-entraining Admixtures—ASTM Designation: C 260.

- C. Calcium Chloride—ASTM Designation: D 98.

- D. Mineral Admixtures—Coal fly ash; raw or calcined natural pozzolan as specified in ASTM Designation: C 618; silica fume conforming to the requirements in ASTM Designation: C 1240, with reduction of mortar expansion of 80 percent, minimum, using the cement from the proposed mix design.

- Unless otherwise specified in the special provisions, mineral admixtures shall be used in conformance with the provisions in Section 90-4.08, "Required Use of Mineral Admixtures."

90-3 AGGREGATE GRADINGS

90-3.01 GENERAL

- Before beginning concrete work, the Contractor shall submit in writing to the Engineer the gradation of the primary aggregate nominal sizes that the Contractor proposes to furnish. If a primary coarse aggregate or the fine aggregate is separated into 2 or more sizes, the proposed gradation shall consist of the gradation for each individual size, and the proposed proportions of each individual size, combined mathematically to indicate one proposed gradation. The proposed gradation shall meet the grading requirements shown in the table in this section, and shall show the percentage passing each of the sieve sizes used in determining the end result.

- The Engineer may waive, in writing, the gradation requirements in this Section 90-3.01 and in Sections 90-3.02, "Coarse Aggregate Grading," 90-3.03, "Fine Aggregate Grading," and 90-3.04, "Combined Aggregate Gradings," if, in the Engineer's opinion, furnishing the gradation is not necessary for the type or amount of concrete work to be constructed.

- Gradations proposed by the Contractor shall be within the following percentage passing limits:

Primary Aggregate Nominal Size	Sieve Size	Limits of Proposed Gradation
37.5-mm x 19-mm	25-mm	19 - 41
25-mm x 4.75-mm	19-mm	52 - 85
25-mm x 4.75-mm	9.5-mm	15 - 38
12.5-mm x 4.75-mm	9.5-mm	40 - 78
9.5-mm x 2.36-mm	9.5-mm	50 - 85
Fine Aggregate	1.18-mm	55 - 75
Fine Aggregate	600-µm	34 - 46
Fine Aggregate	300-µm	16 - 29

- Should the Contractor change the source of supply, the Contractor shall submit in writing to the Engineer the new gradations before their intended use.

90-3.02 COARSE AGGREGATE GRADING

- The grading requirements for coarse aggregates are shown in the following table for each size of coarse aggregate:

Sieve Sizes	Percentage Passing Primary Aggregate Nominal Sizes							
	37.5-mm x 19-mm		25-mm x 4.75-mm		12.5-mm x 4.75-mm		9.5-mm x 2.36-mm	
	Operating Range	Contract Compliance	Operating Range	Contract Compliance	Operating Range	Contract Compliance	Operating Range	Contract Compliance
50-mm	100	100	—	—	—	—	—	—
37.5-mm	88-100	85-100	100	100	—	—	—	—
25-mm	x ± 18	X ± 25	88-100	86-100	—	—	—	—
19-mm	0-17	0-20	X ± 15	X ± 22	100	100	—	—
12.5-mm	—	—	—	—	82-100	80-100	100	100
9.5-mm	0-7	0-9	X ± 15	X ± 22	X ± 15	X ± 22	X ± 15	X ± 20
4.75-mm	—	—	0-16	0-18	0-15	0-18	0-25	0-28
2.36-mm	—	—	0-6	0-7	0-6	0-7	0-6	0-7

- In the above table, the symbol X is the gradation that the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."
- Coarse aggregate for the 37.5-mm, maximum, combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," shall be furnished in 2 or more primary aggregate nominal sizes. Each primary aggregate nominal size may be separated into 2 sizes and stored separately, provided that the combined material conforms to the grading requirements for that particular primary aggregate nominal size.
- When the 25-mm, maximum, combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," is to be used, the coarse aggregate may be separated into 2 sizes and stored separately, provided that the combined material shall conform to the grading requirements for the 25-mm x 4.75-mm primary aggregate nominal size.

90-3.03 FINE AGGREGATE GRADING

- Fine aggregate shall be graded within the following limits:

Sieve Sizes	Percentage Passing	
	Operating Range	Contract Compliance
9.5-mm	100	100
4.75-mm	95-100	93-100
2.36-mm	65-95	61-99
1.18-mm	X ± 10	X ± 13
600-µm	X ± 9	X ± 12
300-µm	X ± 6	X ± 9
150-µm	2-12	1-15
75-µm	0-8	0-10

- In the above table, the symbol X is the gradation that the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."
- In addition to the above required grading analysis, the distribution of the fine aggregate sizes shall be such that the difference between the total percentage passing the 1.18-mm sieve and the total percentage passing the 600- μ m sieve shall be between 10 and 40, and the difference between the percentage passing the 600- μ m and 300- μ m sieves shall be between 10 and 40.
- Fine aggregate may be separated into 2 or more sizes and stored separately, provided that the combined material conforms to the grading requirements specified in this Section 90-3.03.

90-3.04 COMBINED AGGREGATE GRADINGS

- Combined aggregate grading limits shall be used only for the design of concrete mixes. Concrete mixes shall be designed so that aggregates are combined in proportions that shall produce a mixture within the grading limits for combined aggregates as specified herein. Within these limitations, the relative proportions shall be as ordered by the Engineer, except as otherwise provided in Section 90-1.01, "Description."
- The combined aggregate grading used in portland cement concrete pavement shall be the 37.5-mm, maximum grading.
- The combined aggregate grading used in concrete for structures and other concrete items, except when specified otherwise in these specifications or the special provisions, shall be either the 37.5-mm, maximum grading, or the 25-mm, maximum grading, at the option of the Contractor.

Grading Limits of Combined Aggregates

Sieve Sizes	Percentage Passing			
	37.5-mm Max.	25-mm Max.	12.5-mm Max.	9.5-mm Max.
50-mm	100	—	—	—
37.5-mm	90-100	100	—	—
25-mm	50-86	90-100	—	—
19-mm	45-75	55-100	100	—
12.5-mm	—	—	90-100	100
9.5-mm	38-55	45-75	55-86	50 - 100
4.75-mm	30-45	35-60	45-63	45 - 63
2.36-mm	23-38	27-45	35-49	35 - 49
1.18-mm	17-33	20-35	25-37	25 - 37
600- μ m	10-22	12-25	15-25	15 - 25
300- μ m	4-10	5-15	5-15	5 - 15
150- μ m	1-6	1-8	1-8	1 - 8
75- μ m	0-3	0-4	0-4	0 - 4

- Changes from one grading to another shall not be made during the progress of the work unless permitted by the Engineer.

90-4 ADMIXTURES

90-4.01 GENERAL

- Admixtures used in portland cement concrete shall conform to and be used in conformance with the provisions in this Section 90-4 and the special provisions. Admixtures shall be used when specified or ordered by the Engineer and may be used at the Contractor's option as provided herein.
- Chemical admixtures and air-entraining admixtures containing chlorides as Cl in excess of one percent by mass of admixture, as determined by California Test 415, shall not be used in prestressed or reinforced concrete.
- Calcium chloride shall not be used in concrete containing steel reinforcement or other embedded metals.
- Mineral admixture used in concrete for exposed surfaces of like elements of a structure shall be from the same source and of the same percentage.
- Admixtures shall be uniform in properties throughout their use in the work. Should it be found that an admixture as furnished is not uniform in properties, its use shall be discontinued.
- If more than one admixture is used, the admixtures shall be compatible with each other so that the desirable effects of all admixtures used will be realized.

90-4.02 MATERIALS

- Admixture materials shall conform to the provisions in Section 90-2.04, "Admixture Materials."

90-4.03 ADMIXTURE APPROVAL

- No admixture brand shall be used in the work unless it is on the Department's current list of approved brands for the type of admixture involved.
- Admixture brands will be considered for addition to the approved list if the manufacturer of the admixture submits to the Transportation Laboratory a sample of the admixture accompanied by certified test results demonstrating that the admixture complies with the requirements in the appropriate ASTM Designation and these specifications. The sample shall be sufficient to permit performance of all required tests. Approval of admixture brands will be dependent upon a determination as to compliance with the requirements, based on the certified test results submitted, together with tests the Department may elect to perform.
- When the Contractor proposes to use an admixture of a brand and type on the current list of approved admixture brands, the Contractor shall furnish a Certificate of Compliance from the manufacturer, as provided in Section 6-1.07, "Certificates of Compliance," certifying that the admixture furnished is the same as that previously approved. If a previously approved admixture is not accompanied by a Certificate of Compliance, the admixture shall not be used in the work until the Engineer has had sufficient time to make the appropriate tests and has approved the admixture for use. The Engineer may take samples for testing at any time, whether or not the admixture has been accompanied by a Certificate of Compliance.
- If a mineral admixture is delivered directly to the site of the work, the Certificate of Compliance shall be signed by the manufacturer or supplier of the mineral admixture. If the mineral admixture is used in ready-mix concrete or in precast concrete products purchased as such by the Contractor, the Certificate of Compliance shall be signed by the manufacturer of the concrete or product.

90-4.04 REQUIRED USE OF CHEMICAL ADMIXTURES AND CALCIUM CHLORIDE

- When the use of a chemical admixture or calcium chloride is specified or ordered by the Engineer, the admixture shall be used at the dosage specified or ordered, except that if no dosage is specified or ordered, the admixture shall be used at the dosage normally recommended by the manufacturer of the admixture.
- Calcium chloride shall be dispensed in liquid, flake, or pellet form. Calcium chloride dispensed in liquid form shall conform to the provisions for dispensing liquid admixtures in Section 90-4.10, "Proportioning and Dispensing Liquid Admixtures."

90-4.05 OPTIONAL USE OF CHEMICAL ADMIXTURES

- The Contractor will be permitted to use Type A or F, water-reducing; Type B, retarding; or Type D or G, water-reducing and retarding admixtures as described in ASTM Designation: C 494 to conserve cementitious material or to facilitate any concrete construction application subject to the following conditions:
 - A. When a water-reducing admixture or a water-reducing and retarding admixture is used, the cementitious material content specified or ordered may be reduced by a maximum of 5 percent by mass, except that the resultant cementitious material content shall be not less than 300 kilograms per cubic meter; and
 - B. When a reduction in cementitious material content is made, the dosage of admixture used shall be the dosage used in determining approval of the admixture.
- Unless otherwise specified, a Type C accelerating chemical admixture conforming to the requirements in ASTM Designation: C 494, may be used in portland cement concrete. Inclusion in the mix design submitted for approval will not be required provided that the admixture is added to counteract changing conditions that contribute to delayed setting of the portland cement concrete, and the use or change in dosage of the admixture is approved in writing by the Engineer.

90-4.06 REQUIRED USE OF AIR-ENTRAINING ADMIXTURES

- When air-entrainment is specified or ordered by the Engineer, the air-entraining admixture shall be used in amounts to produce a concrete having the specified air content as determined by California Test 504.

90-4.07 OPTIONAL USE OF AIR-ENTRAINING ADMIXTURES

- When air-entrainment has not been specified or ordered by the Engineer, the Contractor will be permitted to use an air-entraining admixture to facilitate the use of any construction procedure or equipment provided that the average air content, as determined by California Test 504, of 3 successive tests does not exceed 4 percent, and no single test value

exceeds 5.5 percent. If the Contractor elects to use an air-entraining admixture in concrete for pavement, the Contractor shall so indicate at the time the Contractor designates the source of aggregate as provided in Section 40-1.015, "Cement Content."

90-4.08 REQUIRED USE OF MINERAL ADMIXTURES

- Unless otherwise specified, mineral admixture shall be combined with cement to make cementitious material.
- The calcium oxide content of mineral admixtures shall not exceed 10 percent and the available alkali, as sodium oxide equivalent, shall not exceed 1.5 percent when determined in conformance with the requirements in ASTM Designation: C 618.
- The amounts of cement and mineral admixture used in cementitious material shall be sufficient to satisfy the minimum cementitious material content requirements specified in Section 90-1.01, "Description," or Section 90-4.05, "Optional Use of Chemical Admixtures," and shall conform to the following:
 - A. The minimum amount of cement shall not be less than 75 percent by mass of the specified minimum cementitious material content;
 - B. The minimum amount of mineral admixture to be combined with cement shall be determined using one of the following criteria:
 1. When the calcium oxide content of a mineral admixture is equal to or less than 2 percent by mass, the amount of mineral admixture shall not be less than 15 percent by mass of the total amount of cementitious material to be used in the mix;
 2. When the calcium oxide content of a mineral admixture is greater than 2 percent, the amount of mineral admixture shall not be less than 25 percent by mass of the total amount of cementitious material to be used in the mix;
 3. When a mineral admixture that conforms to the provisions for silica fume in Section 90-2.04, "Admixture Materials," is used, the amount of mineral admixture shall not be less than 10 percent by mass of the total amount of cementitious material to be used in the mix
 - C. The total amount of mineral admixture shall not exceed 35 percent by mass of the total amount of cementitious material to be used in the mix. Where Section 90-1.01, "Description," specifies a maximum cementitious content in kilograms per cubic meter, the total mass of cement and mineral admixture per cubic meter shall not exceed the specified maximum cementitious material content.

90-4.09 BLANK

90-4.10 PROPORTIONING AND DISPENSING LIQUID ADMIXTURES

- Chemical admixtures and air-entraining admixtures shall be dispensed in liquid form. Dispensers for liquid admixtures shall have sufficient capacity to measure at one time the prescribed quantity required for each batch of concrete. Each dispenser shall include a graduated measuring unit into which liquid admixtures are measured to within ± 5 percent of the prescribed quantity for each batch. Dispensers shall be located and maintained so that the graduations can be accurately read from the point at which proportioning operations are controlled to permit a visual check of batching accuracy prior to discharge. Each measuring unit shall be clearly marked for the type and quantity of admixture.
- Each liquid admixture dispensing system shall be equipped with a sampling device consisting of a valve located in a safe and readily accessible position such that a sample of the admixture may be withdrawn slowly by the Engineer.
- If more than one liquid admixture is used in the concrete mix, each liquid admixture shall have a separate measuring unit and shall be dispensed by injecting equipment located in such a manner that the admixtures are not mixed at high concentrations and do not interfere with the effectiveness of each other. When air-entraining admixtures are used in conjunction with other liquid admixtures, the air-entraining admixture shall be the first to be incorporated into the mix.
- When automatic proportioning devices are required for concrete pavement, dispensers for liquid admixtures shall operate automatically with the batching control equipment. The dispensers shall be equipped with an automatic warning system in good operating condition that will provide a visible or audible signal at the point at which proportioning operations are controlled when the quantity of admixture measured for each batch of concrete varies from the preselected dosage by more than 5 percent, or when the entire contents of the measuring unit are not emptied from the dispenser into each batch of concrete.
- Unless liquid admixtures are added to premeasured water for the batch, their discharge into the batch shall be arranged to flow into the stream of water so that the admixtures are well dispersed throughout the batch, except that air-entraining admixtures may be dispensed directly into moist sand in the batching bins provided that adequate control of the air content of the concrete can be maintained.

- Liquid admixtures requiring dosages greater than 2.5 L/m³ shall be considered to be water when determining the total amount of free water as specified in Section 90-6.06, "Amount of Water and Penetration."
- Special admixtures, such as "high range" water reducers that may contribute to a high rate of slump loss, shall be measured and dispensed as recommended by the admixture manufacturer and as approved by the Engineer.

90-4.11 STORAGE, PROPORTIONING, AND DISPENSING OF MINERAL ADMIXTURES

- Mineral admixtures shall be protected from exposure to moisture until used. Sacked material shall be piled to permit access for tally, inspection and identification for each shipment.
- Adequate facilities shall be provided to assure that mineral admixtures meeting the specified requirements are kept separate from other mineral admixtures in order to prevent any but the specified mineral admixtures from entering the work. Safe and suitable facilities for sampling mineral admixtures shall be provided at the weigh hopper or in the feed line immediately in advance of the hopper.
- Mineral admixtures shall be incorporated into concrete using equipment conforming to the requirements for cement weigh hoppers, and charging and discharging mechanisms in ASTM Designation: C 94, in Section 90-5.03, "Proportioning," and in this Section 90-4.11.
- When concrete is completely mixed in stationary paving mixers, the mineral admixture shall be weighed in a separate weigh hopper conforming to the provisions for cement weigh hoppers and charging and discharging mechanisms in Section 90-5.03A, "Proportioning for Pavement," and the mineral admixture and cement shall be introduced simultaneously into the mixer proportionately with the aggregate. If the mineral admixture is not weighed in a separate weigh hopper, the Contractor shall provide certification that the stationary mixer is capable of mixing the cement, admixture, aggregates and water uniformly prior to discharge. Certification shall contain the following:

- A. Test results for 2 compressive strength test cylinders of concrete taken within the first one-third and 2 compressive strength test cylinders of concrete taken within the last one-third of the concrete discharged from a single batch from the stationary paving mixer. Strength tests and cylinder preparation will be in conformance with the provisions of Section 90-9, "Compressive Strength;"
- B. Calculations demonstrating that the difference in the averages of 2 compressive strengths taken in the first one-third is no greater than 7.5 percent different than the averages of 2 compressive strengths taken in the last one-third of the concrete discharged from a single batch from the stationary paving mixer. Strength tests and cylinder preparation will be in conformance with the provisions of Section 90-9, "Compressive Strength;" and
- C. The mixer rotation speed and time of mixing prior to discharge that are required to produce a mix that meets the requirements above.

90-5 PROPORTIONING

90-5.01 STORAGE OF AGGREGATES

- Aggregates shall be stored or stockpiled in such a manner that separation of coarse and fine particles of each size shall be avoided and also that the various sizes shall not become intermixed before proportioning.
 - Aggregates shall be stored or stockpiled and handled in a manner that shall prevent contamination by foreign materials. In addition, storage of aggregates at batching or mixing facilities that are erected subsequent to the award of the contract and that furnish concrete to the project shall conform to the following:
- A. Intermingling of the different sizes of aggregates shall be positively prevented. The Contractor shall take the necessary measures to prevent intermingling. The preventive measures may include, but are not necessarily limited to, physical separation of stockpiles or construction of bulkheads of adequate length and height; and
 - B. Contamination of aggregates by contact with the ground shall be positively prevented. The Contractor shall take the necessary measures to prevent contamination. The preventive measures shall include, but are not necessarily limited to, placing aggregates on wooden platforms or on hardened surfaces consisting of portland cement concrete, asphalt concrete, or cement treated material.
- In placing aggregates in storage or in moving the aggregates from storage to the weigh hopper of the batching plant, any method that may cause segregation, degradation, or the combining of materials of different gradings that will result in any size of aggregate at the weigh hopper failing to meet the grading requirements, shall be discontinued. Any method of handling aggregates that results in excessive breakage of particles shall be discontinued. The use of suitable devices to reduce impact of falling aggregates may be required by the Engineer.

90-5.02 PROPORTIONING DEVICES

- Weighing, measuring, or metering devices used for proportioning materials shall conform to the requirements in Section 9-1.01, "Measurement of Quantities," and this Section 90-5.02. In addition, automatic weighing systems shall comply with the requirements for automatic proportioning devices in Section 90-5.03A, "Proportioning for Pavement." Automatic devices shall be automatic to the extent that the only manual operation required for proportioning the aggregates, cement, and mineral admixture for one batch of concrete is a single operation of a switch or starter.

- Proportioning devices shall be tested at the expense of the Contractor as frequently as the Engineer may deem necessary to ensure their accuracy.

- Weighing equipment shall be insulated against vibration or movement of other operating equipment in the plant. When the plant is in operation, the mass of each batch of material shall not vary from the mass designated by the Engineer by more than the tolerances specified herein.

- Equipment for cumulative weighing of aggregate shall have a zero tolerance of ± 0.5 percent of the designated total batch mass of the aggregate. For systems with individual weigh hoppers for the various sizes of aggregate, the zero tolerance shall be ± 0.5 percent of the individual batch mass designated for each size of aggregate. Equipment for cumulative weighing of cement and mineral admixtures shall have a zero tolerance of ± 0.5 percent of the designated total batch mass of the cement and mineral admixture. Equipment for weighing cement or mineral admixture separately shall have a zero tolerance of ± 0.5 percent of their designated individual batch masses. Equipment for measuring water shall have a zero tolerance of ± 0.5 percent of its designated mass or volume.

- The mass indicated for any batch of material shall not vary from the preselected scale setting by more than the following:

- A. Aggregate weighed cumulatively shall be within 1.0 percent of the designated total batch mass of the aggregate. Aggregates weighed individually shall be within 1.5 percent of their respective designated batch masses; and
- B. Cement shall be within 1.0 percent of its designated batch mass. When weighed individually, mineral admixture shall be within 1.0 percent of its designated batch mass. When mineral admixture and cement are permitted to be weighed cumulatively, cement shall be weighed first to within 1.0 percent of its designated batch mass, and the total for cement and mineral admixture shall be within 1.0 percent of the sum of their designated batch masses; and
- C. Water shall be within 1.5 percent of its designated mass or volume.

- Each scale graduation shall be approximately 0.001 of the total capacity of the scale. The capacity of scales for weighing cement, mineral admixture, or cement plus mineral admixture and aggregates shall not exceed that of commercially available scales having single graduations indicating a mass not exceeding the maximum permissible mass variation above, except that no scale shall be required having a capacity of less than 500 kg, with 0.5-kg graduations.

90-5.03 PROPORTIONING

- Proportioning shall consist of dividing the aggregates into the specified sizes, each stored in a separate bin, and combining them with cement, mineral admixture, and water as provided in these specifications. Aggregates shall be proportioned by mass.

- At the time of batching, aggregates shall have been dried or drained sufficiently to result in a stable moisture content such that no visible separation of water from aggregate will take place during transportation from the proportioning plant to the point of mixing. In no event shall the free moisture content of the fine aggregate at the time of batching exceed 8 percent of its saturated, surface-dry mass.

- Should separate supplies of aggregate material of the same size group, but of different moisture content or specific gravity or surface characteristics affecting workability, be available at the proportioning plant, withdrawals shall be made from one supply exclusively and the materials therein completely exhausted before starting upon another.

- Bulk "Type IP (MS) Modified" cement shall be weighed in an individual hopper and shall be kept separate from the aggregates until the ingredients are released for discharge into the mixer.

- Bulk cement and mineral admixture may be weighed in separate, individual weigh hoppers or may be weighed in the same weigh hopper and shall be kept separate from the aggregates until the ingredients are released for discharge into the mixer. If the cement and mineral admixture are weighed cumulatively, the cement shall be weighed first.

- When cement and mineral admixtures are weighed in separate weigh hoppers, the weigh systems for the proportioning of the aggregate, the cement, and the mineral admixture shall be individual and distinct from all other weigh systems. Each weigh system shall be equipped with a hopper, a lever system, and an indicator to constitute an individual and independent material weighing device. The cement and the mineral admixture shall be discharged into the mixer simultaneously with the aggregate.

- The scales and weigh hoppers for bulk weighing cement, mineral admixture, or cement plus mineral admixture shall be separate and distinct from the aggregate weighing equipment.

- For batches with a volume of one cubic meter or more, the batching equipment shall conform to one of the following combinations:

- A. Separate boxes and separate scale and indicator for weighing each size of aggregate.
- B. Single box and scale indicator for all aggregates.
- C. Single box or separate boxes and automatic weighing mechanism for all aggregates.

- In order to check the accuracy of batch masses, the gross mass and tare mass of batch trucks, truck mixers, truck agitators, and non-agitating hauling equipment shall be determined when ordered by the Engineer. The equipment shall be weighed at the Contractor's expense on scales designated by the Engineer.

90-5.03A Proportioning for Pavement

- Aggregates and bulk cement, mineral admixture, and cement plus mineral admixture for use in pavement shall be proportioned by mass by means of automatic proportioning devices of approved type conforming to these specifications.

- The Contractor shall install and maintain in operating condition an electronically actuated moisture meter that will indicate, on a readily visible scale, changes in the moisture content of the fine aggregate as it is batched within a sensitivity of 0.5 percent by mass of the fine aggregate.

- The batching of cement, mineral admixture, or cement plus mineral admixture and aggregate shall be interlocked so that a new batch cannot be started until all weigh hoppers are empty, the proportioning devices are within zero tolerance, and the discharge gates are closed. The interlock shall permit no part of the batch to be discharged until all aggregate hoppers and the cement and mineral admixture hoppers or the cement plus mineral admixture hopper are charged with masses that are within the tolerances specified in Section 90-5.02, "Proportioning Devices."

- When interlocks are required for cement and mineral admixture charging mechanisms and cement and mineral admixtures are weighed cumulatively, their charging mechanisms shall be interlocked to prevent the introduction of mineral admixture until the mass of cement in the cement weigh hopper is within the tolerances specified in Section 90-5.02, "Proportioning Devices."

- The discharge gate on the cement and mineral admixture hoppers or the cement plus mineral admixture hopper shall be designed to permit regulating the flow of cement, mineral admixture, or cement plus mineral admixture into the aggregate as directed by the Engineer.

- When separate weigh boxes are used for each size of aggregate, the discharge gates shall permit regulating the flow of each size of aggregate as directed by the Engineer.

- Material discharged from the several bins shall be controlled by gates or by mechanical conveyors. The means of withdrawal from the several bins, and of discharge from the weigh box, shall be interlocked so that not more than one bin can discharge at a time, and so that the weigh box cannot be tripped until the required quantity from each of the several bins has been deposited therein. Should a separate weigh box be used for each size of aggregate, all may be operated and discharged simultaneously.

- When the discharge from the several bins is controlled by gates, each gate shall be actuated automatically so that the required mass is discharged into the weigh box, after which the gate shall automatically close and lock.

- The automatic weighing system shall be designed so that all proportions required may be set on the weighing controller at the same time.

90-6 MIXING AND TRANSPORTING

90-6.01 GENERAL

- Concrete shall be mixed in mechanically operated mixers, except that when permitted by the Engineer, batches not exceeding 0.25 m³ may be mixed by hand methods in conformance with the provisions in Section 90-6.05, "Hand-Mixing."

- Equipment having components made of aluminum or magnesium alloys that would have contact with plastic concrete during mixing, transporting, or pumping of portland cement concrete shall not be used.

- Concrete shall be homogeneous and thoroughly mixed, and there shall be no lumps or evidence of undispersed cement, mineral admixture, or cement plus mineral admixture.

- Uniformity of concrete mixtures will be determined by differences in penetration as determined by California Test 533, or slump as determined by ASTM Designation: C 143, and by variations in the proportion of coarse aggregate as determined by California Test 529.

- When the mix design specifies a penetration value, the difference in penetration, determined by comparing penetration tests on 2 samples of mixed concrete from the same batch or truck mixer load, shall not exceed 10 mm. When the mix design specifies a slump value, the difference in slump, determined by comparing slump tests on 2 samples of mixed concrete from the same batch or truck mixer load, shall not exceed the values given in the table below. Variation in the proportion of coarse aggregate will be determined by comparing the results of tests of 2 samples of mixed concrete from the same batch or truck mixer load and the difference between the 2 results shall not exceed 100 kg per cubic meter of concrete.

Average Slump	Maximum Permissible Difference
Less than 100-mm	25-mm
100-mm to 150-mm	38-mm
Greater than 150-mm to 225-mm	50-mm

- The Contractor, at the Contractor's expense, shall furnish samples of the freshly mixed concrete and provide satisfactory facilities for obtaining the samples.

90-6.02 MACHINE MIXING

- Concrete mixers may be of the revolving drum or the revolving blade type, and the mixing drum or blades shall be operated uniformly at the mixing speed recommended by the manufacturer. Mixers and agitators that have an accumulation of hard concrete or mortar shall not be used.

- The temperature of mixed concrete, immediately before placing, shall be not less than 10°C or more than 32°C. Aggregates and water shall be heated or cooled as necessary to produce concrete within these temperature limits. Neither aggregates nor mixing water shall be heated to exceed 65°C. If ice is used to cool the concrete, discharge of the mixer will not be permitted until all ice is melted.

- The batch shall be so charged into the mixer that some water will enter in advance of cementitious materials and aggregates. All water shall be in the drum by the end of the first one - fourth of the specified mixing time.

- Cementitious materials shall be batched and charged into the mixer by means that will not result either in loss of cementitious materials due to the effect of wind, in accumulation of cementitious materials on surfaces of conveyors or hoppers, or in other conditions that reduce or vary the required quantity of cementitious material in the concrete mixture.

- Paving and stationary mixers shall be operated with an automatic timing device. The timing device and discharge mechanism shall be interlocked so that during normal operation no part of the batch will be discharged until the specified mixing time has elapsed.

- The total elapsed time between the intermingling of damp aggregates and all cementitious materials and the start of mixing shall not exceed 30 minutes.

- The size of batch shall not exceed the manufacturer's guaranteed capacity.

- When producing concrete for pavement or base, suitable batch counters shall be installed and maintained in good operating condition at jobsite batching plants and stationary mixers. The batch counters shall indicate the exact number of batches proportioned and mixed.

- Concrete shall be mixed and delivered to the jobsite by means of one of the following combinations of operations:

- Mixed completely in a stationary mixer and the mixed concrete transported to the point of delivery in truck agitators or in non-agitating hauling equipment (central-mixed concrete).
- Mixed partially in a stationary mixer, and the mixing completed in a truck mixer (shrink-mixed concrete).
- Mixed completely in a truck mixer (transit-mixed concrete).
- Mixed completely in a paving mixer.

- Agitators may be truck mixers operating at agitating speed or truck agitators. Each mixer and agitator shall have attached thereto in a prominent place a metal plate or plates on which is plainly marked the various uses for which the equipment is designed, the manufacturer's guaranteed capacity of the drum or container in terms of the volume of mixed concrete and the speed of rotation of the mixing drum or blades.

- Truck mixers shall be equipped with electrically or mechanically actuated revolution counters by which the number of revolutions of the drum or blades may readily be verified.

- When shrink-mixed concrete is furnished, concrete that has been partially mixed at a central plant shall be transferred to a truck mixer and all requirements for transit-mixed concrete shall apply. No credit in the number of revolutions at mixing speed shall be allowed for partial mixing in a central plant.

90-6.03 TRANSPORTING MIXED CONCRETE

- Mixed concrete may be transported to the delivery point in truck agitators or truck mixers operating at the speed designated by the manufacturer of the equipment as agitating speed, or in non-agitating hauling equipment, provided the consistency and workability of the mixed concrete upon discharge at the delivery point is suitable for adequate placement and consolidation in place, and provided the mixed concrete after hauling to the delivery point conforms to the provisions in Section 90-6.01, "General."
- Truck agitators shall be loaded not to exceed the manufacturer's guaranteed capacity and shall maintain the mixed concrete in a thoroughly mixed and uniform mass during hauling.
- Bodies of non-agitating hauling equipment shall be constructed so that leakage of the concrete mix, or any part thereof, will not occur at any time.
- Concrete hauled in open-top vehicles shall be protected during hauling against rain or against exposure to the sun for more than 20 minutes when the ambient temperature exceeds 24°C.
- No additional mixing water shall be incorporated into the concrete during hauling or after arrival at the delivery point, unless authorized by the Engineer. If the Engineer authorizes additional water to be incorporated into the concrete, the drum shall be revolved not less than 30 revolutions at mixing speed after the water is added and before discharge is commenced.
- The rate of discharge of mixed concrete from truck mixer-agitators shall be controlled by the speed of rotation of the drum in the discharge direction with the discharge gate fully open.
- When a truck mixer or agitator is used for transporting concrete to the delivery point, discharge shall be completed within 1.5 hours or before 250 revolutions of the drum or blades, whichever occurs first, after the introduction of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 30°C or above, the time allowed may be less than 1.5 hours.
- When non-agitating hauling equipment is used for transporting concrete to the delivery point, discharge shall be completed within one hour after the addition of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 30°C or above, the time between the introduction of cement to the aggregates and discharge shall not exceed 45 minutes.
- Each load of concrete delivered at the jobsite shall be accompanied by a weighmaster certificate showing the mix identification number, non-repeating load number, date and time at which the materials were batched, the total amount of water added to the load, and for transit-mixed concrete, the reading of the revolution counter at the time the truck mixer is charged with cement. This weighmaster certificate shall also show the actual scale masses (kilograms) for the ingredients batched. Theoretical or target batch masses shall not be used as a substitute for actual scale masses.
- Weighmaster certificates shall be provided in printed form, or if approved by the Engineer, the data may be submitted in electronic media. Electronic media shall be presented in a tab-delimited format on a 90 mm diskette with a capacity of at least 1.4 megabytes. Captured data, for the ingredients represented by each batch shall be "line feed, carriage return" (LFCR) and "one line, separate record" with allowances for sufficient fields to satisfy the amount of data required by these specifications.
- The Contractor may furnish a weighmaster certificate accompanied by a separate certificate that lists the actual batch masses or measurements for a load of concrete provided that both certificates are imprinted with the same non-repeating load number that is unique to the contract and delivered to the jobsite with the load.
- Weighmaster certificates furnished by the Contractor shall conform to the provisions in Section 9-1.01, "Measurement of Quantities."

90-6.04 TIME OR AMOUNT OF MIXING

- Mixing of concrete in paving or stationary mixers shall continue for the required mixing time after all ingredients, except water and admixture, if added with the water, are in the mixing compartment of the mixer before any part of the batch is released. Transfer time in multiple drum mixers shall not be counted as part of the required mixing time.
- The required mixing time, in paving or stationary mixers, of concrete used for concrete structures, except minor structures, shall be not less than 90 seconds or more than 5 minutes, except that when directed by the Engineer in writing, the requirements of the following paragraph shall apply.
- The required mixing time, in paving or stationary mixers, except as provided in the preceding paragraph, shall be not less than 50 seconds or more than 5 minutes.
- The minimum required revolutions at the mixing speed for transit-mixed concrete shall not be less than that recommended by the mixer manufacturer, but in no case shall the number of revolutions be less than that required to consistently produce concrete conforming to the provisions for uniformity in Section 90-6.01, "General."

90-6.05 HAND-MIXING

- Hand-mixed concrete shall be made in batches of not more than 0.25 m³ and shall be mixed on a watertight, level platform. The proper amount of coarse aggregate shall be measured in measuring boxes and spread on the platform and the fine aggregate shall be spread on this layer, the 2 layers being not more than 0.3 meters in total depth. On this mixture shall be spread the dry cement and mineral admixture and the whole mass turned no fewer than 2 times dry; then sufficient clean water shall be added, evenly distributed, and the whole mass again turned no fewer than 3 times, not including placing in the carriers or forms.

90-6.06 AMOUNT OF WATER AND PENETRATION

- The amount of water used in concrete mixes shall be regulated so that the penetration of the concrete as determined by California Test 533 or the slump of the concrete as determined by ASTM Designation: C 143 is within the "Nominal" values shown in the following table. When the penetration or slump of the concrete is found to exceed the nominal values listed, the mixture of subsequent batches shall be adjusted to reduce the penetration or slump to a value within the nominal range shown. Batches of concrete with a penetration or slump exceeding the maximum values listed shall not be used in the work. When Type F or Type G chemical admixtures are added to the mix, the penetration requirements shall not apply and the slump shall not exceed 225 mm after the chemical admixtures are added.

Type of Work	Nominal		Maximum	
	Penetration (mm)	Slump (mm)	Penetration (mm)	Slump (mm)
Concrete Pavement	0-25	—	40	—
Non-reinforced concrete facilities	0-35	—	50	—
Reinforced concrete structures				
Sections over 300-mm thick	0-35	—	65	—
Sections 300-mm thick or less	0-50	—	75	—
Concrete placed under water	—	150-200	—	225
Cast-in-place concrete piles	65-90	130-180	100	200

- The amount of free water used in concrete shall not exceed 183 kg/m³, plus 20 kg for each required 100 kg of cementitious material in excess of 325 kg/m³. The term free water is defined as the total water in the mixture minus the water absorbed by the aggregates in reaching a saturated surface-dry condition.

- Where there are adverse or difficult conditions that affect the placing of concrete, the above specified penetration and free water content limitations may be exceeded providing the Contractor is granted permission by the Engineer in writing to increase the cementitious material content per cubic meter of concrete. The increase in water and cementitious material shall be at a ratio not to exceed 30 kg of water per added 100 kg of cementitious material per cubic meter. The cost of additional cementitious material and water added under these conditions shall be at the Contractor's expense and no additional compensation will be allowed therefor.

- The equipment for supplying water to the mixer shall be constructed and arranged so that the amount of water added can be measured accurately. Any method of discharging water into the mixer for a batch shall be accurate within 1.5 percent of the quantity of water required to be added to the mix for any position of the mixer. Tanks used to measure water shall be designed so that water cannot enter while water is being discharged into the mixer and discharge into the mixer shall be made rapidly in one operation without dribbling. All equipment shall be arranged so as to permit checking the amount of water delivered by discharging into measured containers.

90-7 CURING CONCRETE

90-7.01 METHODS OF CURING

- Newly placed concrete shall be cured by the methods specified in this Section 90-7.01 and the special provisions.

90-7.01A Water Method

- The concrete shall be kept continuously wet by the application of water for a minimum curing period of 7 days after the concrete has been placed.

- When a curing medium consisting of cotton mats, rugs, carpets, or earth or sand blankets is to be used to retain the moisture, the entire surface of the concrete shall be kept damp by applying water with a nozzle that so atomizes the flow that a mist and not a spray is formed, until the surface of the concrete is covered with the curing medium. The moisture from the nozzle shall not be applied under pressure directly upon the concrete and shall not be allowed to accumulate on the concrete

in a quantity sufficient to cause a flow or wash the surface. At the expiration of the curing period, the concrete surfaces shall be cleared of all curing mediums.

- When concrete bridge decks and flat slabs are to be cured without the use of a curing medium, the entire surface of the bridge deck or slab shall be kept damp by the application of water with an atomizing nozzle as specified in the preceding paragraph, until the concrete has set, after which the entire surface of the concrete shall be sprinkled continuously with water for a period of not less than 7 days.

90-7.01B Curing Compound Method

- Surfaces of the concrete that are exposed to the air shall be sprayed uniformly with a curing compound.
- Curing compounds to be used shall be as follows:
 1. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class B, except the resin type shall be poly-alpha-methylstyrene.
 2. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class B.
 3. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class A.
 4. Non-pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 1, Class B.
 5. Non-pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 1, Class A.
 6. Non-pigmented curing compound with fugitive dye conforming to the requirements in ASTM Designation: C 309, Type 1-D, Class A.
- The infrared scan for the dried vehicle from curing compound (1) shall match the infrared scan on file at the Transportation Laboratory.
 - The loss of water for each type of curing compound, when tested in conformance with the requirements in California Test 534, shall not be more than 0.15-kg/m² in 24 hours or more than 0.45-kg/m² in 72 hours.
 - The curing compound to be used will be specified elsewhere in these specifications or in the special provisions.
 - When the use of curing compound is required or permitted elsewhere in these specifications or in the special provisions and no specific kind is specified, any of the curing compounds listed above may be used.
 - Curing compound shall be applied at a nominal rate of 3.7 m²/L, unless otherwise specified.
 - At any point, the application rate shall be within ± 1.2 m²/L of the nominal rate specified, and the average application rate shall be within ± 0.5 m²/L of the nominal rate specified when tested in conformance with the requirements in California Test 535. Runs, sags, thin areas, skips, or holidays in the applied curing compound shall be evidence that the application is not satisfactory.
 - Curing compounds shall be applied using power operated spray equipment. The power operated spraying equipment shall be equipped with an operational pressure gage and a means of controlling the pressure. Hand spraying of small and irregular areas that are not reasonably accessible to mechanical spraying equipment, in the opinion of the Engineer, may be permitted.
 - The curing compound shall be applied to the concrete following the surface finishing operation, immediately before the moisture sheen disappears from the surface, but before any drying shrinkage or craze cracks begin to appear. In the event of any drying or cracking of the surface, application of water with an atomizing nozzle as specified in Section 90-7.01A, "Water Method," shall be started immediately and shall be continued until application of the compound is resumed or started; however, the compound shall not be applied over any resulting freestanding water. Should the film of compound be damaged from any cause before the expiration of 7 days after the concrete is placed in the case of structures and 72 hours in the case of pavement, the damaged portion shall be repaired immediately with additional compound.
 - At the time of use, compounds containing pigments shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. A paddle shall be used to loosen all settled pigment from the bottom of the container, and a power driven agitator shall be used to disperse the pigment uniformly throughout the vehicle.
 - Agitation shall not introduce air or other foreign substance into the curing compound.
 - The manufacturer shall include in the curing compound the necessary additives for control of sagging, pigment settling, leveling, de-emulsification, or other requisite qualities of a satisfactory working material. Pigmented curing compounds shall be manufactured so that the pigment does not settle badly, does not cake or thicken in the container, and does not become granular or curdled. Settlement of pigment shall be a thoroughly wetted, soft, mushy mass permitting the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with minimum resistance to the sideways manual motion of the paddle across the bottom of the container, to form a smooth uniform product of the proper consistency.
 - Curing compounds shall remain sprayable at temperatures above 4°C and shall not be diluted or altered after manufacture.

- The curing compound shall be packaged in clean 210-L barrels or round 19-L containers or shall be supplied from a suitable storage tank located at the jobsite. The containers shall comply with "Title 49, Code of Federal Regulations, Hazardous Materials Regulations." The 210-L barrels shall have removable lids and airtight fasteners. The 19-L containers shall be round and have standard full open head and bail. Lids with bungholes shall not be permitted. On-site storage tanks shall be kept clean and free of contaminants. Each tank shall have a permanent system designed to completely redisperse settled material without introducing air or other foreign substances.

- Steel containers and lids shall be lined with a coating that will prevent destructive action by the compound or chemical agents in the air space above the compound. The coating shall not come off the container or lid as skins. Containers shall be filled in a manner that will prevent skinning. Plastic containers shall not react with the compound.

- Each container shall be labeled with the manufacturer's name, kind of curing compound, batch number, volume, date of manufacture, and volatile organic compound (VOC) content. The label shall also warn that the curing compound containing pigment shall be well stirred before use. Precautions concerning the handling and the application of curing compound shall be shown on the label of the curing compound containers in conformance with the Construction Safety Orders and General Industry Safety Orders of the State of California.

- Containers of curing compound shall be labeled to indicate that the contents fully comply with the rules and regulations concerning air pollution control in the State of California.

- When the curing compound is shipped in tanks or tank trucks, a shipping invoice shall accompany each load. The invoice shall contain the same information as that required herein for container labels.

- Curing compound will be sampled by the Engineer at the source of supply or at the jobsite or at both locations.

- Curing compound shall be formulated so as to maintain the specified properties for a minimum of one year. The Engineer may require additional testing before use to determine compliance with these specifications if the compound has not been used within one year or whenever the Engineer has reason to believe the compound is no longer satisfactory.

- Tests will be conducted in conformance with the latest ASTM test methods and methods in use by the Transportation Laboratory.

90-7.01C Waterproof Membrane Method

- The exposed finished surfaces of concrete shall be sprayed with water, using a nozzle that so atomizes the flow that a mist and not a spray is formed, until the concrete has set, after which the curing membrane shall be placed. The curing membrane shall remain in place for a period of not less than 72 hours.

- Sheeting material for curing concrete shall conform to the requirements in AASHTO Designation: M 171 for white reflective materials.

- The sheeting material shall be fabricated into sheets of such width as to provide a complete cover for the entire concrete surface. Joints in the sheets shall be securely cemented together in such a manner as to provide a waterproof joint. The joint seams shall have a minimum lap of 100 mm.

- The sheets shall be securely weighted down by placing a bank of earth on the edges of the sheets or by other means satisfactory to the Engineer.

- Should any portion of the sheets be broken or damaged before the expiration of 72 hours after being placed, the broken or damaged portions shall be immediately repaired with new sheets properly cemented into place.

- Sections of membrane that have lost their waterproof qualities or have been damaged to such an extent as to render them unfit for curing the concrete shall not be used.

90-7.01D Forms-In-Place Method

- Formed surfaces of concrete may be cured by retaining the forms in place. The forms shall remain in place for a minimum period of 7 days after the concrete has been placed, except that for members over 0.5-m in least dimension the forms shall remain in place for a minimum period of 5 days.

- Joints in the forms and the joints between the end of forms and concrete shall be kept moisture tight during the curing period. Cracks in the forms and cracks between the forms and the concrete shall be resealed by methods subject to the approval of the Engineer.

90-7.02 CURING PAVEMENT

- The entire exposed area of the pavement, including edges, shall be cured by the waterproof membrane method, or curing compound method using curing compound (1) or (2) as the Contractor may elect. Should the side forms be removed before the expiration of 72 hours following the start of curing, the exposed pavement edges shall also be cured. If the pavement is cured by means of the curing compound method, the sawcut and all portions of the curing compound that have been disturbed by sawing operations shall be restored by spraying with additional curing compound.

- Curing shall commence as soon as the finishing process provided in Section 40-1.10, "Final Finishing," has been completed. The method selected shall conform to the provisions in Section 90-7.01, "Methods of Curing."
- When the curing compound method is used, the compound shall be applied to the entire pavement surface by mechanical sprayers. Spraying equipment shall be of the fully atomizing type equipped with a tank agitator that provides for continual agitation of the curing compound during the time of application. The spray shall be adequately protected against wind, and the nozzles shall be so oriented or moved mechanically transversely as to result in the minimum specified rate of coverage being applied uniformly on exposed faces. Hand spraying of small and irregular areas, and areas inaccessible to mechanical spraying equipment, in the opinion of the Engineer, will be permitted. When the ambient air temperature is above 15°C, the Contractor shall fog the surface of the concrete with a fine spray of water as specified in Section 90-7.01A, "Water Method." The surface of the pavement shall be kept moist between the hours of 10:00 a.m. and 4:30 p.m. on the day the concrete is placed. However, the fogging done after the curing compound has been applied shall not begin until the compound has set sufficiently to prevent displacement. Fogging shall be discontinued if ordered in writing by the Engineer.

90-7.03 CURING STRUCTURES

- Newly placed concrete for cast-in-place structures, other than highway bridge decks, shall be cured by the water method, the forms-in-place method, or, as permitted herein, by the curing compound method, in conformance with the provisions in Section 90-7.01, "Methods of Curing."
- The curing compound method using a pigmented curing compound may be used on concrete surfaces of construction joints, surfaces that are to be buried underground, and surfaces where only Ordinary Surface Finish is to be applied and on which a uniform color is not required and that will not be visible from a public traveled way. If the Contractor elects to use the curing compound method on the bottom slab of box girder spans, the curing compound shall be curing compound (1).
- The top surface of highway bridge decks shall be cured by both the curing compound method and the water method. The curing compound shall be curing compound (1). The curing compound shall be applied progressively during the deck finishing operations immediately after finishing operations are completed on each individual portion of the deck. The water cure shall be applied not later than 4 hours after completion of deck finishing or, for portions of the decks on which finishing is completed after normal working hours, the water cure shall be applied not later than the following morning.
- Concrete surfaces of minor structures, as defined in Section 51-1.02, "Minor Structures," shall be cured by the water method, the forms-in-place method or the curing compound method.
- When deemed necessary by the Engineer during periods of hot weather, water shall be applied to concrete surfaces being cured by the curing compound method or by the forms-in-place method, until the Engineer determines that a cooling effect is no longer required. Application of water for this purpose will be paid for as extra work as provided in Section 4-1.03D, "Extra Work."

90-7.04 CURING PRECAST CONCRETE MEMBERS

- Precast concrete members shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing." Curing shall be provided for the minimum time specified for each method or until the concrete reaches its design strength, whichever is less. Steam curing may also be used for precast members and shall conform to the following provisions:
 - A. After placement of the concrete, members shall be held for a minimum 4-hour presteaming period. If the ambient air temperature is below 10°C, steam shall be applied during the presteaming period to hold the air surrounding the member at a temperature between 10°C and 32°C.
 - B. To prevent moisture loss on exposed surfaces during the presteaming period, members shall be covered as soon as possible after casting or the exposed surfaces shall be kept wet by fog spray or wet blankets.
 - C. Enclosures for steam curing shall allow free circulation of steam about the member and shall be constructed to contain the live steam with a minimum moisture loss. The use of tarpaulins or similar flexible covers will be permitted, provided they are kept in good repair and secured in such a manner as to prevent the loss of steam and moisture.
 - D. Steam at the jets shall be at low pressure and in a saturated condition. Steam jets shall not impinge directly on the concrete, test cylinders, or forms. During application of the steam, the temperature rise within the enclosure shall not exceed 22°C per hour. The curing temperature throughout the enclosure shall not exceed 65°C and shall be maintained at a constant level for a sufficient time necessary to develop the required transfer strength. Control cylinders shall be covered to prevent moisture loss and shall be placed in a location where temperature is representative of the average temperature of the enclosure.

- E. Temperature recording devices that will provide an accurate, continuous, permanent record of the curing temperature shall be provided. A minimum of one temperature recording device per 60 m of continuous bed length will be required for checking temperature.
- F. Members in pretension beds shall be detensioned immediately after the termination of steam curing while the concrete and forms are still warm, or the temperature under the enclosure shall be maintained above 15°C until the stress is transferred to the concrete.
- G. Curing of precast concrete will be considered completed after termination of the steam curing cycle.

90-7.05 CURING PRECAST PRESTRESSED CONCRETE PILES

- Newly placed concrete for precast prestressed concrete piles shall be cured in conformance with the provisions in Section 90-7.04, "Curing Precast Concrete Members," except that piles with a class designation ending in C (corrosion resistant) shall be cured as follows:

- A. Piles shall be either steam cured or water cured. If water curing is used, the piles shall be kept continuously wet by the application of water in conformance with the provisions in Section 90-7.01A, "Water Method."
- B. If steam curing is used, the steam curing provisions in Section 90-7.04, "Curing Precast Concrete Members," shall apply except that the piles shall be kept continuously wet for their entire length for a period of not less than 3 days, including the holding and steam curing periods.

90-7.06 CURING SLOPE PROTECTION

- Concrete slope protection shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing."
- Concreted-rock slope protection shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing," or with a blanket of earth kept wet for 72 hours, or by sprinkling with a fine spray of water every 2 hours during the daytime for a period of 3 days.

90-7.07 CURING MISCELLANEOUS CONCRETE WORK

- Exposed surfaces of curbs shall be cured by pigmented curing compounds as specified in Section 90-7.01B, "Curing Compound Method."
- Concrete sidewalks, gutter depressions, island paving, curb ramps, driveways, and other miscellaneous concrete areas shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing."
- Shotcrete shall be cured for at least 72 hours by spraying with water, or by a moist earth blanket, or by any of the methods provided in Section 90-7.01, "Methods of Curing."
- Mortar and grout shall be cured by keeping the surface damp for 3 days.
- After placing, the exposed surfaces of sign structure foundations, including pedestal portions, if constructed, shall be cured for at least 72 hours by spraying with water, or by a moist earth blanket, or by any of the methods provided in Section 90-7.01, "Methods of Curing."

90-8 PROTECTING CONCRETE

90-8.01 GENERAL

- In addition to the provisions in Section 7-1.16, "Contractor's Responsibility for the Work and Materials," the Contractor shall protect concrete as provided in this Section 90-8.
- Concrete shall not be placed on frozen or ice-coated ground or subgrade nor on ice-coated forms, reinforcing steel, structural steel, conduits, precast members, or construction joints.
- Under rainy conditions, placing of concrete shall be stopped before the quantity of surface water is sufficient to damage surface mortar or cause a flow or wash of the concrete surface, unless the Contractor provides adequate protection against damage.
- Concrete that has been frozen or damaged by other causes, as determined by the Engineer, shall be removed and replaced by the Contractor at the Contractor's expense.

90-8.02 PROTECTING CONCRETE STRUCTURES

- Structure concrete and shotcrete used as structure concrete shall be maintained at a temperature of not less than 7°C for 72 hours after placing and at not less than 4°C for an additional 4 days. When required by the Engineer, the Contractor shall submit a written outline of the proposed methods for protecting the concrete.

90-8.03 PROTECTING CONCRETE PAVEMENT

- Pavement concrete shall be maintained at a temperature of not less than 4°C for 72 hours. When required by the Engineer, the Contractor shall submit a written outline of the proposed methods for protecting the concrete.
- Except as provided in Section 7-1.08, "Public Convenience," the Contractor shall protect concrete pavement against construction and other activities that abrade, scar, discolor, reduce texture depth, lower coefficient of friction, or otherwise damage the surface. Stockpiling, drifting, or excessive spillage of soil, gravel, petroleum products, and concrete or asphalt mixes on the surface of concrete pavement is prohibited unless otherwise specified in these specifications, the special provisions or permitted by the Engineer.
- When ordered by the Engineer or shown on the plans or specified in the special provisions, pavement crossings shall be constructed for the convenience of public traffic. The material and work necessary for the construction of the crossings, and their subsequent removal and disposal, will be paid for at the contract unit prices for the items of work involved and if there are no contract items for the work involved, payment for pavement crossings will be made by extra work as provided in Section 4-1.03D, "Extra Work.". Where public traffic will be required to cross over the new pavement, Type III portland cement may be used in concrete, if permitted in writing by the Engineer. The pavement may be opened to traffic as soon as the concrete has developed a modulus of rupture of 3.8 MPa. The modulus of rupture will be determined by California Test 523.
- No traffic or Contractor's equipment, except as hereinafter provided, will be permitted on the pavement before a period of 10 days has elapsed after the concrete has been placed, nor before the concrete has developed a modulus of rupture of at least 3.8 MPa. Concrete that fails to attain a modulus of rupture of 3.8 MPa within 10 days shall not be opened to traffic until directed by the Engineer.
- Equipment for sawing weakened plane joints will be permitted on the pavement as specified in Section 40-1.08B, "Weakened Plane Joints."
- When requested in writing by the Contractor, the tracks on one side of paving equipment will be permitted on the pavement after a modulus of rupture of 2.4 MPa has been attained, provided that:
 - A. Unit pressure exerted on the pavement by the paver shall not exceed 135 kPa;
 - B. Tracks with cleats, grousers, or similar protuberances shall be modified or shall travel on planks or equivalent protective material, so that the pavement is not damaged; and
 - C. No part of the track shall be closer than 0.3-m from the edge of pavement.
- In case of visible cracking of, or other damage to the pavement, operation of the paving equipment on the pavement shall be immediately discontinued.
- Damage to the pavement resulting from early use of pavement by the Contractor's equipment as provided above shall be repaired by the Contractor at the Contractor's expense.
- The State will furnish the molds and machines for testing the concrete for modulus of rupture, and the Contractor, at the Contractor's expense, shall furnish the material and whatever labor the Engineer may require.

90-9 COMPRESSIVE STRENGTH

90-9.01 GENERAL

- Concrete compressive strength requirements consist of a minimum strength that shall be attained before various loads or stresses are applied to the concrete and, for concrete designated by strength, a minimum strength at the age of 28 days or at the age otherwise allowed in Section 90-1.01, "Description." The various strengths required are specified in these specifications or the special provisions or are shown on the plans.
- The compressive strength of concrete will be determined from test cylinders that have been fabricated from concrete sampled in conformance with the requirements of ASTM Designation: C 172. Test cylinders will be molded and initially field cured in conformance with California Test 540. Test cylinders will be cured and tested after receipt at the testing laboratory in conformance with the requirements of ASTM Designation: C 39. A strength test shall consist of the average strength of 2 cylinders fabricated from material taken from a single load of concrete, except that, if any cylinder should show evidence of improper sampling, molding, or testing, that cylinder shall be discarded and the strength test shall consist of the strength of the remaining cylinder.
- When concrete compressive strength is specified as a prerequisite to applying loads or stresses to a concrete structure or member, test cylinders for other than steam cured concrete will be cured in conformance with Method 1 of California Test 540. The compressive strength of concrete determined for these purposes will be evaluated on the basis of individual tests.

- When concrete is designated by 28-day compressive strength rather than by cementitious material content, the concrete strength to be used as a basis for acceptance of other than steam cured concrete will be determined from cylinders cured in conformance with Method 1 of California Test 540. If the result of a single compressive strength test at the maximum age specified or allowed is below the specified strength but is 95 percent or more of the specified strength, the Contractor shall, at the Contractor's expense, make corrective changes, subject to approval of the Engineer, in the mix proportions or in the concrete fabrication procedures, before placing additional concrete, and shall pay to the State \$14 for each in-place cubic meter of concrete represented by the deficient test. If the result of a single compressive strength test at the maximum age specified or allowed is below 95 percent of the specified strength, but is 85 percent or more of the specified strength, the Contractor shall make the corrective changes specified above, and shall pay to the State \$20 for each in place cubic meter of concrete represented by the deficient test. In addition, such corrective changes shall be made when the compressive strength of concrete tested at 7 days indicates, in the judgment of the Engineer, that the concrete will not attain the required compressive strength at the maximum age specified or allowed. Concrete represented by a single test that indicates a compressive strength of less than 85 percent of the specified 28-day compressive strength will be rejected in conformance with the provisions in Section 6-1.04, "Defective Materials."

- If the test result indicates that the compressive strength at the maximum curing age specified or allowed is below the specified strength, but is 85 percent or more of the specified strength, payments to the State as required above shall be made, unless the Contractor, at the Contractor's expense, obtains and submits evidence acceptable to the Engineer that the strength of the concrete placed in the work meets or exceeds the specified 28-day compressive strength. If the test result indicates a compressive strength at the maximum curing age specified or allowed below 85 percent, the concrete represented by that test will be rejected, unless the Contractor, at the Contractor's expense, obtains and submits evidence acceptable to the Engineer that the strength and quality of the concrete placed in the work are acceptable. If the evidence consists of tests made on cores taken from the work, the cores shall be obtained and tested in conformance with the requirements in ASTM Designation: C 42.

- No single compressive strength test shall represent more than 250 m³.

- When a precast concrete member is steam cured, the compressive strength of the concrete will be determined from test cylinders that have been handled and stored in conformance with Method 3 of California Test 540. The compressive strength of steam cured concrete will be evaluated on the basis of individual tests representing specific portions of production. When the concrete is designated by 28-day compressive strength rather than by cementitious material content, the concrete shall be considered to be acceptable whenever its compressive strength reaches the specified 28-day compressive strength provided that strength is reached in not more than the maximum number of days specified or allowed after the member is cast.

- When concrete is specified by compressive strength, prequalification of materials, mix proportions, mixing equipment, and procedures proposed for use will be required prior to placement of the concrete. Prequalification shall be accomplished by the submission of acceptable certified test data or trial batch reports by the Contractor. Prequalification data shall be based on the use of materials, mix proportions, mixing equipment, procedures, and size of batch proposed for use in the work.

- Certified test data, in order to be acceptable, shall indicate that not less than 90 percent of at least 20 consecutive tests exceed the specified strength at the maximum number of cure days specified or allowed, and none of those tests are less than 95 percent of specified strength. Strength tests included in the data shall be the most recent tests made on concrete of the proposed mix design and all shall have been made within one year of the proposed use of the concrete.

- Trial batch test reports, in order to be acceptable, shall indicate that the average compressive strength of 5 consecutive concrete cylinders, taken from a single batch, at not more than 28 days (or the maximum age allowed) after molding shall be at least 4 MPa greater than the specified 28-day compressive strength, and no individual cylinder shall have a strength less than the specified strength at the maximum age specified or allowed. Data contained in the report shall be from trial batches that were produced within one year of the proposed use of specified strength concrete in the project. Whenever air-entrainment is required, the air content of trial batches shall be equal to or greater than the air content specified for the concrete without reduction due to tolerances.

- Tests shall be performed in conformance with either the appropriate California Test methods or the comparable ASTM test methods. Equipment employed in testing shall be in good condition and shall be properly calibrated. If the tests are performed during the life of the contract, the Engineer shall be notified sufficiently in advance of performing the tests in order to witness the test procedures.

- The certified test data and trial batch test reports shall include the following information:

- A. Date of mixing.
- B. Mixing equipment and procedures used.
- C. The size of batch in cubic meters and the mass, type, and source of all ingredients used.
- D. Penetration of the concrete.

- E. The air content of the concrete if an air-entraining admixture is used.
- F. The age at time of testing and strength of all concrete cylinders tested.

- Certified test data and trial batch test reports shall be signed by an official of the firm that performed the tests.
- When approved by the Engineer, concrete from trial batches may be used in the work at locations where concrete of a lower quality is required and the concrete will be paid for as the type or class of concrete required at that location.
- After materials, mix proportions, mixing equipment, and procedures for concrete have been prequalified for use, additional prequalification by testing of trial batches will be required prior to making changes that, in the judgment of the Engineer, could result in a strength of concrete below that specified.
- The Contractor's attention is directed to the time required to test trial batches and the Contractor shall be responsible for production of trial batches at a sufficiently early date so that the progress of the work is not delayed.
- When precast concrete members are manufactured at the plant of an established manufacturer of precast concrete members, the mix proportions of the concrete shall be determined by the Contractor, and a trial batch and prequalification of the materials, mix proportions, mixing equipment, and procedures will not be required.

90-10 MINOR CONCRETE

90-10.01 GENERAL

- Concrete for minor structures, slope paving, curbs, sidewalks and other concrete work, when designated as minor concrete on the plans, in the specifications, or in the contract item, shall conform to the provisions specified herein.
- The Engineer, at the Engineer's discretion, will inspect and test the facilities, materials and methods for producing the concrete to ensure that minor concrete of the quality suitable for use in the work is obtained.

90-10.02 MATERIALS

- Minor concrete shall conform to the following requirements:

90-10.02A Cementitious Material

- Cementitious material shall conform to the provisions in Section 90-1.01, "Description."

90-10.02B Aggregate

- Aggregate shall be clean and free from deleterious coatings, clay balls, roots, and other extraneous materials.
- The Contractor shall submit to the Engineer for approval, a grading of the combined aggregate proposed for use in the minor concrete. After acceptance of the grading, aggregate furnished for minor concrete shall conform to that grading, unless a change is authorized in writing by the Engineer.
- The Engineer may require the Contractor to furnish periodic test reports of the aggregate grading furnished. The maximum size of aggregate used shall be at the option of the Contractor, but in no case shall the maximum size be larger than 37.5 mm or smaller than 19 mm.
- The Engineer may waive, in writing, the gradation requirements in this Section 90-10.02B, if, in the Engineer's opinion, the furnishing of the gradation is not necessary for the type or amount of concrete work to be constructed.

90-10.02C Water

- Water used for washing, mixing, and curing shall be free from oil, salts, and other impurities that would discolor or etch the surface or have an adverse affect on the quality of the concrete.

90-10.02D Admixtures

- The use of admixtures shall conform to the provisions in Section 90-4, "Admixtures."

90-10.03 PRODUCTION

- Cementitious material, water, aggregate, and admixtures shall be stored, proportioned, mixed, transported, and discharged in conformance with recognized standards of good practice that will result in concrete that is thoroughly and uniformly mixed, that is suitable for the use intended, and that conforms to requirements specified herein. Recognized standards of good practice are outlined in various industry publications such as are issued by American Concrete Institute, AASHTO, or the Department.
- The cementitious material content of minor concrete shall conform to the provisions in Section 90-1.01, "Description."

- The amount of water used shall result in a consistency of concrete conforming to the provisions in Section 90-6.06, "Amount of Water and Penetration." Additional mixing water shall not be incorporated into the concrete during hauling or after arrival at the delivery point, unless authorized by the Engineer.
- Discharge of ready-mixed concrete from the transporting vehicle shall be made while the concrete is still plastic and before stiffening occurs. An elapsed time of 1.5 hours (one hour in non-agitating hauling equipment), or more than 250 revolutions of the drum or blades, after the introduction of the cementitious material to the aggregates, or a temperature of concrete of more than 32°C will be considered conditions contributing to the quick stiffening of concrete. The Contractor shall take whatever action is necessary to eliminate quick stiffening, except that the addition of water will not be permitted.
- The required mixing time in stationary mixers shall be not less than 50 seconds or more than 5 minutes.
- The minimum required revolutions at mixing speed for transit-mixed concrete shall be not less than that recommended by the mixer manufacturer, and shall be increased, if necessary, to produce thoroughly and uniformly mixed concrete.
- Each load of ready-mixed concrete shall be accompanied by a weighmaster certificate that shall be delivered to the Engineer at the discharge location of the concrete, unless otherwise directed by the Engineer. The weighmaster certificate shall be clearly marked with the date and time of day when the load left the batching plant and, if hauled in truck mixers or agitators, the time the mixing cycle started.
- A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," shall be furnished to the Engineer, prior to placing minor concrete from a source not previously used on the contract, stating that minor concrete to be furnished meets contract requirements, including minimum cementitious material content specified.

90-10.04 CURING MINOR CONCRETE

- Curing minor concrete shall conform to the provisions in Section 90-7, "Curing Concrete."

90-10.05 PROTECTING MINOR CONCRETE

- Protecting minor concrete shall conform to the provisions in Section 90-8, "Protecting Concrete," except the concrete shall be maintained at a temperature of not less than 4°C for 72 hours after placing.

90-10.06 MEASUREMENT AND PAYMENT

- Minor concrete will be measured and paid for in conformance with the provisions specified in the various sections of these specifications covering concrete construction when minor concrete is specified in the specifications, shown on the plans, or indicated by contract item in the Engineer's Estimate.

90-11 MEASUREMENT AND PAYMENT

90-11.01 MEASUREMENT

- Portland cement concrete will be measured in conformance with the provisions specified in the various sections of these specifications covering construction requiring concrete.
- When it is provided that concrete will be measured at the mixer, the volume in cubic meters shall be computed as the total mass of the batch in kilograms divided by the density of the concrete in kilograms per cubic meter. The total mass of the batch shall be calculated as the sum of all materials, including water, entering the batch. The density of the concrete will be determined in conformance with the requirements in California Test 518.

90-11.02 PAYMENT

- Portland cement concrete will be paid for in conformance with the provisions specified in the various sections of these specifications covering construction requiring concrete.
- Full compensation for furnishing and incorporating admixtures required by these specifications or the special provisions will be considered as included in the contract prices paid for the concrete involved and no additional compensation will be allowed therefor.
- Should the Engineer order the Contractor to incorporate any admixtures in the concrete when their use is not required by these specifications or the special provisions, furnishing the admixtures and adding them to the concrete will be paid for as extra work as provided in Section 4-1.03D, "Extra Work."
- Should the Contractor use admixtures in conformance with the provisions in Section 90-4.05, "Optional Use of Chemical Admixtures," or Section 90-4.07, "Optional Use of Air-entraining Admixtures," or should the Contractor request and obtain permission to use other admixtures for the Contractor's benefit, the Contractor shall furnish those admixtures and incorporate them into the concrete at the Contractor's expense and no additional compensation will be allowed therefor.

SECTION 12. (BLANK)

SECTION 13. RAILROAD RELATIONS AND INSURANCE

RULES AND REQUIREMENTS FOR CONSTRUCTION ON RAILWAY PROPERTY SCRRA FORM NO. 37

State Contract No. 07-129944

PART 1 - GENERAL

1.01 Purpose

The rules and requirements are to protect SCRRA's operations, including the proper manner of protecting the tracks, signals, fiber optic cables, pipe lines, other Property, and tenants or licensees upon, adjacent to, across (under, and/or over), and along SCRRA and Member Agency Property during the construction and/or maintenance activities on or adjacent to Railway Property.

1.02 Definitions

SCRRA, is a joint powers authority of five county transportation authorities, organized under the provisions of the Joint Powers Act, Sections, 6500 et seq. of the California Government Code, and Section 130255 of the California Public Utilities Code, that builds, maintains, and operates Metrolink commuter railway system within Los Angeles, Orange, Riverside, San Bernardino and Ventura Counties.

MEMBER AGENCY is that specific county transportation Member Agency(s), whose Property is directly affected by the Contractor's actions herein. The five county transportation Member Agencies are the Los Angeles County Metropolitan Transportation Authority, the Orange County Transportation Authority, the Riverside County Transportation Commission, the San Bernardino Associated Governments, and the Ventura County Transportation Commission.

PROPERTY is defined herein to mean the real and/or personal Property of SCRRA or Member Agency(s).

CONTRACTOR, is an individual, firm, third party, partnership or corporation, or combination thereof, private, municipal or public, including joint ventures, retained by SCRRA or another public entity to provide construction or maintenance services which may impact SCRRA Property and who is referred to throughout this document by singular number and masculine gender.

PUBLIC AGENCY, is defined to mean (i) the federal government and any agencies, departments or subdivisions thereof, and (ii) the State of California or any other state, and any county, city, city and county, district, public authority, public agency, joint powers, municipal corporation, or any other political subdivision or public corporation therein.

1.03 Submittal

Within five (5) working days prior to the planned initiation of any work which may infringe on SCRRA or Member Agency Property, the Contractor shall furnish SCRRA with three sets of, working drawings showing details of construction affecting the tracks and property, specifications, falsework plans, falsework removal plans, shoring plans, shoring or cribbing plans not included in the contract, shop drawings, traffic plans, and other incidents not detailed in plans. The Contractor shall also furnish three sets of calculations of any falsework, shoring, or cribbing which are to be located over, under or adjacent to tracks. Construction details affecting the tracks and the Property, and not included in the contract plans shall be submitted to SCRRA by way of the Public Agency for approval. Plans and calculations shall be stamped by a registered Professional Engineer licensed in the State of California.

The Contractor shall not begin any work until notified by SCRRA that such plans have been approved. Approval of the plans and calculations by SCRRA shall not relieve the Contractor of responsibility for full compliance with contract requirements, for correctness of dimensions, clearances and material quantities, for proper design of details, for proper fabrication and construction techniques, for proper coordination with other trades, and for providing all devices required for safe and satisfactory construction and operation.

PART 2 - RULES AND REQUIREMENTS

2.01 References

When working on the Property, the Contractor must comply with the rules and regulations contained in the current editions of the following documents which are "references" incorporated in this document as if they were set in full in this paragraph. The Contractor agrees to abide by said rules and regulations at all times when on the Property.

1. Right-of-Entry agreement, SCRRA Form No. 6

The Right-of-Entry agreement is an agreement between SCRRA and the Contractor that permit the Contractor, under certain agreed upon conditions, to encroach upon, adjacent to, across (under and/or over), and along SCRRA or Member Agency Property.

2. General Safety Regulations for Construction/Maintenance Activity on Railway Property.

The Regulations are for the benefit of employees of the Contractors and others who are involved in construction, maintenance or other activities on the right-of-way. The Regulations were developed in the interest of safety and protection of trains, passengers or personnel of SCRRA, Member Agency, Operating Railroad(s), and the employees of the Contractor.

3. California Public Utilities Commission (CPUC) General Orders.
4. American Railway Engineering and Maintenance-of-Way Association (AREMA), Manual for Railway Engineering.
5. SCRRA Engineering Standards.

2.02 Coordination

The Contractor shall cooperate with SCRRA where work is over or under the tracks, or within the limits of the Property, so as to expedite the work and to avoid interference with the operation of Railway equipment.

The Contractor must understand the Contractor's right to enter the Property is subject to the absolute right of SCRRA or Member Agency to cause the Contractor's work on the Property to cease if, in the opinion of SCRRA or Member Agency, Contractor's activities create hazard to the Property, employees, and/or operations.

It is expected that SCRRA and Member Agency will cooperate with the Contractor such that the work may be handled and performed in an efficient manner, but the Contractor shall have no claim whatsoever for any type of damages or for extra or additional compensation in the event its work is delayed by the work of SCRRA or Member Agency.

The Contractor shall take protective measures as are necessary to keep the Property, including track ballast, free of sand, debris, and other foreign objects and materials resulting from its operations. Any damage to the Property resulting from Contractor's operations will be repaired or replaced by SCRRA or Member Agency at their option and the cost of such repairs or replacement shall be recovered from the Contractor.

The Contractor will perform the construction work in such a manner and at such times as shall not endanger or interfere with SCRRA or Member Agency's operations, including relation to the proper manner of protecting the tracks, signals, fiber optic cables, pipe lines, other Property, and tenants or licensees at or in the vicinity of the work during the period of construction.

All forecasts of train traffic and schedules are approximate. The train schedule shall be used for planning purposes only and shall not be used for scheduling actual work around the railroad tracks. SCRRA reserves the right to run as many trains as practical on any track at any time. The operation of the trains will be at sole discretion of SCRRA or Member Agency. The Contractor's work may be halted or delayed whenever necessary to accommodate train service.

2.03 Excavation and Backfill

The Contractor shall compact all backfill to 90 percent of maximum standard density as determined by AASHTO T-99 or ASTM D-698. Where it becomes necessary to excavate beyond the normal lines of excavation to remove boulders or other interfering objects, the voids remaining after such materials are removed shall be back-filled with suitable material approved by SCRRA. The material obtained from the project excavation will be suitable for use as fill or backfill, provided that all organic material, rubbish, debris, large rocks, and other objectionable material is removed. Any excess material must be disposed of by widening fills or hauling off-site. The excess material must not be piled-up or scattered on the right-of-way.

The Contractor shall perform excavation and grading so that the finished surfaces are in uniform planes with no abrupt breaks in surface and having positive drainage on the right-of-way away from the track structure.

2.04 Clearances

The Contractor shall also abide by the following clearances during the course of construction:

- 15'-0" Horizontally from centerline of track (including temporary falsework).
- 22'-6" Vertically above top of rail.
- 21'-6" Vertically above top of rail (Temporary Falsework Clearance - Subject to CPUC approval).
- 27'-0" Vertically above top of rail for electric wires carrying less than 750 volts.
- 28'-0" Vertically above top of rail for electric wires carrying 750 volts to 15,000 volts.
- 30'-0" Vertically above top of rail for electric wires carrying 15,000 volts to 20,000 volts.
- 34'-0" Vertically above top of rail for electric wires carrying more than 20,000 volts.

Any infringement on the above clearances or walkways due to the Contractor's operations shall be submitted to SCRRA and to the Public Agency and shall not be undertaken until approved in writing by SCRRA, and until the Public Agency has obtained any necessary authorization from CPUC for the infringement. No extra compensation will be allowed in the event the Contractor's work is delayed pending SCRRA approval, and/or CPUC authorization.

In the case of impaired vertical clearance above top of rail, SCRRA shall have the option of installing tell-tales or other protective devices SCRRA deems necessary for protection of SCRRA or Member Agency trainmen or rail traffic.

2.05 SCRRA Safety and Protective Services

The Contractor must request and arrange for a flag person, inspector and/or other protective services from SCRRA authorized representative for the following conditions:

- A. When Contractor's personnel and equipment(s) are within twenty (20) feet of the nearest rail.
- B. When any part of any equipment is standing or being operated within or adjacent to the Property, or when any erection or construction activities are in progress within such limits, regardless of elevation above or below track.

- C. For any excavation below the elevation of track sub-grade if, in the opinion of SCRRA or Member Agency's representative, track or other Property may be subject to settlement or movement.
- D. For any clearing, grubbing, grading, or blasting in proximity to the Property which, in the opinion of SCRRA or Member Agency's representative, may endanger the Property or operations.
- E. For any street construction and maintenance activities requiring temporary work area traffic control which may affect or create unsafe conditions for employees, public, trains and vehicles.

SCRRA will furnish such personnel or other protective services when, in the opinion of SCRRA's representative, the Property, including, but not limited to, tracks, buildings, signals, wire lines or pipelines, may be endangered. The Contractor agrees to reimburse SCRRA or Member Agencies for all cost and expense incurred by SCRRA or Member Agency in connection with the safety and protective services.

The cost of flagging and inspection provided by SCRRA or Member Agency on State Contracts during the period of construction that portion of the project located on or near the Property, as deemed necessary for the protection of SCRRA and Member Agency's facilities and trains, will be borne on State for a period of 5 calendar days beginning on the date work commences on or near the Property. The Contractor shall pay to the State liquidated damages in the sum of \$500.00 per day for each day in excess of the above 5 calendar days the Contractor works on or near the Property and which requires flagging protection of SCRRA and Member Agency's facilities and trains.

2.06 Time of Work

The contractor will work daylight hours only and no more than five (5) weekdays (not on Saturday, Sunday or legal holidays) per week. Variations from this schedule must have approval of SCRRA's authorized representative.

2.07 Utilities

The Contractor is responsible for the location and protection of any and all surface, sub-surface, and overhead utilities and structures. Approval of the project and this Right-of-Entry agreement by SCRRA and/or Member Agency does not constitute a representation as to the accuracy of completeness of location or the existence or non-existence of any utilities or structures within the limits of this project. The Contractor shall notify the appropriate regional notification centers [Underground Service Alert (DIGALERT) at 1-800-227-2600], railway companies, and utility companies prior to performing any excavation or other work close to any underground pipeline, conduit, duct, wire, or other structure. SCRRA is not a member of DIGALERT, it is, therefore, necessary to call SCRRA signal department at (909) 392-8476 to mark signals and communications and conduits. In case of signal emergencies or grade crossing problems, the Contractor shall call SCRRA's 24-hour signal emergency number (888) 446-9720.

There are oil, gas, and fiber optic lines running along most of the right-of-way. Damage to any of the lines will create dangerous and hazardous situation. The Contractor is advised to be extra careful while working on the right-of-way.

2.08 Hazardous/Toxic Materials

The Contractor shall operate and maintain the Property in compliance with all, and shall not cause or permit the Property to be in violation of any federal, state or local environmental, health and/or safety-related laws, regulations, standards, decisions of the courts, permits or permit conditions, currently existing or as amended or adopted in the future which are or become applicable to the Contractor or SCRRA or Member Agency Property. Except for hazardous materials expressly approved by SCRRA and Member Agency in writing, the Contractor shall not cause or permit, or allow the Contractor personnel to cause or permit, or any hazardous materials to be brought upon, stored, used, generated, treated or disposed of on or about the Property. Any hazardous materials on the site shall be stored, used, generated and disposed of in accordance with all applicable environmental laws.

In addition, in the event of any release on or contamination of the Property, the Contractor, at its sole expense, shall promptly take all actions necessary to clean up the affected Property (including SCRRRA or Member Agency Property and all affected adjacent Property whether or not owned by SCRRRA or Member Agency) and to return the affected Property to the condition existing prior to such release or contamination, to the satisfaction of SCRRRA and Member Agency and any governmental authorities having jurisdiction thereover.

The Contractor shall cooperate with SCRRRA in any tests or inspections deemed necessary by SCRRRA or Member Agency. The Contractor shall pay or reimburse SCRRRA or Member Agency, as appropriate, for all reasonable costs and expenses incurred due to the tests, inspections or any necessary corrective work and inspections thereafter.

2.09 Explosives

The Contractor will not use or store explosives on the Property without prior written approval from SCRRRA's Director of Engineering and Construction.

2.10 Temporary Construction Crossing(s)

The Contractor shall not move its equipment or materials across the tracks. No vehicular crossing over SCRRRA and/or Member Agency tracks shall be installed or used by contractor without prior written permission of SCRRRA and/or Member Agency. Proper grade crossing warning devices and all other devices required by SCRRRA must be provided at the Contractor's sole cost.

2.11 Traffic Control

The Contractor shall provide safe and effective control near a highway/railway grade crossing. The Contractor shall make every effort to provide safe conditions for employees, public, trains and vehicles. The Contractor shall visit the job site to study traffic conditions, traffic controls, traffic lane requirements, physical features, visibility and pedestrian traffic.

SCRRRA prefers to close the railway/highway grade crossing to vehicle traffic during the construction and maintenance activities. In this case, vehicular traffic shall be rerouted on another street and/or another railway/highway grade crossings. For projects where closure of the railway/highway grade crossing is not possible, the Contractor shall prepare a traffic control plan. The traffic control plan shall comply with applicable, Caltrans, Federal Highway Administration (FHWA) and American Public Works Association (APA) standards. The Contractor shall obtain written approval of the plan from SCRRRA and appropriate local traffic departments prior to initiating any work.

The traffic control plan should include signs, signals, markings, lighting devices, barricades, channelizing, hand signal devices, etc. The traffic control plan should take into consideration all provisions for adequate clearances, lane closures based on traffic volumes, length of time for crossing closure, type of traffic affected, time of day, material and technique of repair, inconvenience, delay and accident potentials.

The traffic control plan shall minimize traffic congestion at the highway/railway grade crossing. Every effort shall be made to have in place emergency traffic escape routes on the downstream side of the highway/railway grade crossing. As many lanes as possible shall be provided for traffic movement in each direction. Traffic detour lanes shall be arranged so that vehicle traffic will be rerouted to both sides of the highway/railway grade crossing. Railroad crossing gate protection must be maintained in both directions at all times. When railroad crossing gate protection can not be provided, a railroad flag person (railroad flag person protects trains and provides notice of train movement, but does not direct vehicular traffic), Contractor's flag person(s) and/or certified traffic control officer(s) must be present at all times. This type of protection will be used for projects with short duration (four days maximum). SCRRRA approval must be obtained and SCRRRA reserves the right to approve or disapprove this type of protection. If this is not possible or feasible, or at SCRRRA's discretion and direction, railroad-crossing gates must be temporarily relocated or installed, at the Contractor's expense, so that the gates are upstream of the traffic and all approaches.

The Contractor shall obtain SCRRA's written approval for any changes in traffic control plan. The Contractor shall notify SCRRA in writing at least five (5) working days in advance of any work on the traffic control at the highway/railway grade crossing.

2.12 Sheeting and Shoring Requirements

The sheeting shall be designed to support all lateral forces caused by the earth, railroad and other surcharge loads. The railroad loading to be applied is a Cooper's E-80 loading.

Footing for all piers, columns, walls, or other facilities shall be located and designed so that any temporary sheeting and shoring for support of adjacent track or tracks during construction shall not be closer than ten (10) feet from the centerline of the nearest track.

When excavation is within the theoretical railroad embankment line {theoretical embankment line starts horizontally from the center line of the track (18 inches below the bottom of the rail) and extend eleven feet and then bend down at a slope of one and half part horizontal to one part vertical (1.5:1)} interlocking steel sheet piling driven prior to excavation, must be used to protect track stability.

Shoring outside of the theoretical railroad embankment line may be of soldier piling and lagging elements. Soldier piling and lagging inside the theoretical railroad embankment line may be used when its use is approved by SCRRA.

Any excavation adjacent to track shall be covered and ramped and provided with standard handrails.

The face of all jacking and receiving pits shall be located a minimum of 25 feet from the center line of the nearest track, measured at right angle to the track, unless otherwise approved by SCRRA. The use of trench boxes may be permitted for jacking and receiving pits; however, trench boxes are not acceptable inside the theoretical railroad embankment line.

2.13 Restoration of Property

Upon completion of its work, the Contractor and its subcontractors shall, at the option of SCRRA and Member Agency (a) leave the Property in a condition satisfactory to SCRRA and Member Agency, (b) restore the Property to its original condition (this may include, without limitation, the restoration of any fences removed or damaged by the Contractor or its subcontractors) and (c) remove all of the Contractor's and its subcontractors' tools, equipment and materials from the Property promptly upon completion of work.

Upon receipt of the Contractor's written assertion that the work has been completed, the work will be inspected by SCRRA for acceptance. All work shall be guaranteed by the Contractor against defective workmanship and material furnished by the Contractor for a period of one (1) year from the date the work was accepted by SCRRA.

**RIGHT-OF-ENTRY AGREEMENT
SCRRA FORM NO. 6**

File No: 50001353

Recollectible No: _____

This Right-of-Entry agreement is between the Southern California Regional Rail Authority

(Hereinafter referred to as **SCRRA**), and _____

_____ (hereinafter referred to as "**Contractor**").

This temporary Right-of-Entry agreement is for the purpose of _____

_____ upon, adjacent to, across (under and/or over), and along
SCRRA and specific county transportation Member Agency(s), (hereinafter referred to as

"**Member Agency**") Property, at or near _____

_____ as shown on attached drawing(s) (to be submitted by the
Contractor with this agreement).

DEFINITIONS

- A. SCRRA, is a joint powers authority of five county transportation agencies, organized under the provisions of the Joint Powers Act, Sections, 6500 et seq. of the California Government Code, and Section 130255 of the California Public Utilities Code, that builds, maintains, and operates Metrolink commuter railroad system within Los Angeles, Orange, Riverside, San Bernardino and Ventura Counties.
- B. MEMBER AGENCY, is that specific county transportation Member Agency(s), whose Property is directly affected by the Contractor's actions herein. The county transportation Member Agencies are the Los Angeles County Metropolitan Transportation Authority, the Orange County Transportation Authority, the Riverside County Transportation Commission, the San Bernardino Associated Governments, and the Ventura County Transportation Commission.
- C. PROPERTY, is defined herein to mean the real and/or personal property of SCRRA and/or Member Agency(s).
- D. INDEMNITIES, are SCRRA and Member Agency, and their respective officers, commissioners, employees, agents, successors and assigns.
- E. CONTRACTOR, is an individual, firm, partnership or corporation, or combination thereof, private, municipal or public, including joint ventures, who is referred to throughout this document by singular number and masculine gender.
- F. OPERATING RAILROAD, is/are that specific passenger or freight related railroad company(s) validly operating on SCRRA and Member Agency track(s). The Operating Railroad are, any combinations of, the National Railroad Passenger Corporation, the Union Pacific Railroad Company, and the Burlington Northern Santa Fe Corporation.

As one of the inducements to and as a part of the consideration for SCRRA and/or Member Agency granting permission to the Contractor to perform such work upon, and adjacent to, across (under, and/or over), and along the Property, the Contractor does hereby agree with SCRRA as follows:

1. References

When working on the Property, the Contractor must comply with the rules and regulations contained in the current editions of the following documents which are "references" incorporated in this document as if they were set out in full in this paragraph. The Contractor, by its signature on the Right-of-Entry agreement, acknowledges receipt of these documents and agrees to abide by said rules and regulations at all times when on the Property.

A. Rules and Requirements for Construction on Railway Property, SCRRA Form No. 37

B. General Safety Regulations for Construction/Maintenance Activity on Railway Property

2. Starting of Use of Property

The Contractor shall not enter onto the Property unless prior thereto the Contractor has possession of a fully executed copy of this Agreement, has arranged for SCRRA safety and protective services (flag person, inspector and/or other protective services), and has paid all charges and fees.

3. Termination of Agreement

SCRRA or Member Agency reserves the right to revoke this temporary agreement at any time upon two hours notice. Unless subsequently modified by SCRRA, this temporary right of entry shall extend until _____, at which time it shall expire automatically. The Contractor agrees to notify SCRRA, in writing and verbally, when use of the Property or work is completed. Under no circumstances shall this temporary right of entry be construed as granting to the Contractor or its subcontractors any right, title or interest of any kind or character in, on, or about any Property.

At the request of SCRRA or Member Agency, Contractor shall remove from the Property any employee of Contractor or any subcontractor or any employee of any subcontractor who fails to conform to the instructions of SCRRA's or Member Agency's representative in connection with work on the Property, and any right of Contractor to enter upon the Property shall be suspended until such request of SCRRA or Member Agency is met. Contractors shall indemnify and hold harmless SCRRA and Member Agency against any claim arising from the removal of any such employee from the Property.

4. Indemnification

Contractor, on behalf of itself and its employees, subcontractors, agents, successors, and assigns, agrees to indemnify, defend, by counsel satisfactory to SCRRA and Member Agency, and hold harmless SCRRA and Member Agency, and their respective officers, commissioners, employees, agents, successors and assigns (hereinafter individually and collectively referred to as, "**Indemnitees**"), and each of them to the maximum extent allowed by law, from and against all loss, liability, claims, demands, suits, liens, claims of lien, damages (including consequential damages), costs and expenses (including, without limitation, any fines, penalties, judgments, actual litigation expenses, and experts' and actual attorneys' fees), that are incurred by or asserted against Indemnitees arising out of or connected in any manner with (i) the acts or omissions to act of the Contractor, or its officers, directors, affiliates, subcontractors or agents or anyone directly or indirectly employed by them or for whose acts the foregoing persons are liable (collectively, "**Personnel**") in connection with or arising from the presence upon or performance of activities by the Contractor or its Personnel with respect to the Property, (ii) bodily and/or personal injury or death of any person (including employees of Indemnitees) or damage to or loss of use of Property resulting from such acts or omissions of the Contractor or its Personnel, or (iii) non-performance or breach by Contractor or its Personnel of any term or condition of this Agreement, in each case whether occurring during the term of this Agreement or thereafter.

The foregoing indemnity shall be effective regardless of any negligence (whether active, passive, derivative, joint, concurring or comparative) on the part of Indemnitees, unless caused solely by the gross negligence or willful misconduct of Indemnitees; shall survive termination of this Agreement; and is in addition to any other rights or remedies which Indemnities may have under the law or under this Agreement.

Claims against the Indemnitees by the Contractor or its Personnel shall not limit the Contractor's indemnification obligations hereunder in any way, whether or not such claims against Indemnities may result in any limitation of the amount or type of damages, compensation, or benefits payable by or for the Contractor or its Personnel under workers' compensation acts, disability benefit acts or other employee benefit acts or insurance.

5. Assumption of Liability

To the maximum extent allowed by law, the Contractor assumes any and all risk of loss, damage or injury of any kind to any person or property, including without limitation, the Property and any other property of, or under the control or custody of, the Contractor or its Personnel. The Contractor's assumption of risk shall include, without limitation, loss or damage caused by defects in any structure or improvement on the Property, accident or fire or other casualty on the Property, or electrical discharge, noise or vibration resulting from SCRRA, Member Agency, and Operating Railroad transit operations on or near the Property and any other persons or companies employed, retained or engaged by SCRRA or Member Agency. The Contractor, on behalf of itself and its Personnel (as defined in above Section 4, "Indemnification") as a material part of the consideration for this Agreement, hereby waives all claims and demands against the Indemnitees or any such loss, damage or injury of the Contractor and/or its Personnel. The Contractor agrees not to file, cause to be filed or initiate any proceeding in law, equity or admiralty whether judicial, administrative, mediation or arbitration against the Indemnitees regarding any such loss, damage or injury of the Contractor and/or its Personnel. In that connection, the Contractor waives the benefit of California Civil Code Section 1542, which provides as follows:

"A general release does not extend to claims which the creditor does not know or suspect to exist in his favor at the time of executing the release, which if known by him must have materially affected his settlement with the debtor."

The Contractor also waives the benefit of any other Statute or Common Law Principles of similar effect.

The provisions of this Section shall survive the termination of this Agreement.

6. Insurance

The Contractor, at its sole cost and expense, shall obtain and maintain in full force and effect during the term of this Agreement insurance as required by SCRRA or Member Agency in the amounts, coverage and terms and conditions specified, (which terms and conditions will require, among other things, SCRRA as insured and Member Agency & Operating Railroad as additional insured on policies provided by Contractor, severability of interests and primary coverage provisions), and issued by insurance companies as described on Exhibit "A". SCRRA or Member Agency reserves the right, throughout the term of this Agreement, to review and change the amount and type of insurance coverage it requires in connection with this Agreement or work to be performed on the Property. Prior to entering the Property or performing any work or maintenance on the Property, the Contractor shall furnish SCRRA with insurance endorsements or certificates in the form of Exhibit "B", evidencing the existence, amounts and coverage of the insurance required to be maintained thereunder signed by a person authorized by the insurer to bind coverage on its behalf. In most instances, SCRRA and Member Agency do not allow self-insurance, however, if the Contractor can demonstrate assets and retention funds meeting SCRRA and Member Agency self-insurance requirements, SCRRA and Member Agency may permit the Contractor to self-insure, provided, however that the right to self-insure with respect to any coverage required to be maintained hereunder may be granted or revoked by SCRRA and Member Agency at their sole and absolute discretion. SCRRA or Member Agency shall not be liable for the payment of any premiums or assessments for insurance required to be maintained by the Contractor under this Agreement.

Prior to the expiration of any policy, the Contractor shall furnish SCRRA with certificates of renewal or "binders" thereof. Each certificate shall expressly state that such policies shall not be cancelable or otherwise subject to modification except after thirty (30) days prior written notice to SCRRA and Member Agency.

7. No Assignment

The Contractor shall not assign this Agreement nor any right hereunder without SCRRA's and Member Agency's prior written consent.

8. Compliance by Contractor

The Contractor shall take all steps necessary to assure that its subcontractors comply with the terms and conditions of this Agreement and applicable laws and regulations. The Contractor shall immediately remove any lien against the Property arising from performance of work hereunder by Contractor or any subcontractor.

9. Safety Orientation Class

The Contractor and his subcontractors may be required to attend Pre-Construction meeting and/or SCRRA Safety Orientation Class prior to receiving permission to enter the Property.

10. SCRRA Safety and Protective Services

The Contractor must request and arrange for a flag person, inspector and/or other protective services from SCRRA authorized representative for the following conditions:

- A. When Contractor's personnel and equipment(s) are within twenty (20) feet of the nearest rail.
- B. When any part of the equipment is standing or being operated within or adjacent to the property, or when any erection or construction activities are in progress within such limits, regardless of elevation above or below track.
- C. For any excavation below the elevation of track sub-grade if, in the opinion of SCRRA or Member Agency representative, track or other Property may be subject to settlement or movement.
- D. For any clearing, grubbing, or blasting in proximity to the Property which, in the opinion of the SCRRA or Member Agency's representative, may endanger the Property or operations.
- E. For any street construction and maintenance activities requiring temporary work area traffic control, which may affect or create unsafe conditions for employees, public, trains & vehicles.

SCRRA will furnish such personnel or other protective services when, in the opinion of SCRRA's representative, the Property, including, but not limited to, tracks, buildings, signals, wire lines or pipelines, may be endangered.

The Contractor shall notify SCRRA a minimum of five (5) working days prior to beginning work on the Property and secure an SCRRA flag person and/or inspector and any other protection SCRRA deems necessary. This prior notification does not guarantee the availability of a flag person or inspector for the proposed date of construction. SCRRA's representative to be contacted prior to entering upon premises is Right of Way Engineer, 700 South Flower Street, Suite 2600, Los Angeles, California 90017-4101, and telephone number (213) 452-0256. The rate for SCRRA inspector and flag person is \$75/hour (4 hours minimum). SCRRA will charge the Contractor for eight (8) hours minimum if the Contractor cancels SCRRA services after SCRRA inspector or flag person is on site on the day of appointment.

11. Reimbursement of Costs and Expenditures

- A. The Contractor agrees to reimburse SCRRA or Member Agency for all cost and expense incurred by SCRRA or Member Agency in connection with said work, including without limitation the expense of furnishing such inspector, and flag person as SCRRA deems necessary, the installation and removal of falsework beneath tracks, restoration of railroad roadbed and tracks, installation of protective devices in case of impaired clearances, and restoration of the Property to the same condition as when Contractor entered thereon, or to a condition satisfactory to SCRRA's and Member Agency's representative.

- B. The Contractor also agrees to reimburse SCRRA, Member Agency and/or Operating Railroad for any and all cost and expense incurred as a result of Contractor's work which may result in (I) delay to the trains or interference in any manner with the operation of trains, (ii) disruption to normal train operation, (iii) unreasonable inconvenience to the public or private user of the system, (iv) loss of revenue, and (v) alternative method of transportation for the passengers. SCRRA will submit final bills to the Contractor for cost incurred.
- C. Prior to commencement of work, the Contractor shall deposit with SCRRA the sum of
dollars (\$
) representing the estimated expense to be incurred by SCRRA and Member Agency in connection with said work. The deposit shall be applied to SCRRA's and Member Agency's actual costs and expenditures. The Contractor shall be responsible to pay any amount exceeding the above deposit upon receipt of notice or invoice by SCRRA. Any deposit amounts in excess of SCRRA's and Member Agency's costs and expenditures shall be returned to the Contractor within reasonable time.
- D. If there is no amount indicated in the blank space provided above for the deposit to be made by the Contractor, and if prior SCRRA approval is obtained, in lieu of such deposit Contractor shall cause surety bond to be executed by a reliable surety acceptable to SCRRA and Member Agency, conditioned upon the faithful performance of the provisions of this Agreement.

On State Contracts, above conditions A, C, and D do not apply. The cost for flagging and inspection on State Contracts shall be borne by the State and paid through the negotiated Service Contract with the Railroad.

12. Traffic Control

The Contractor shall provide safe and effective traffic control near a highway/railway grade crossing. The Contractor shall make every effort to provide safe conditions for employees, public, trains and vehicles.

The Contractor shall refer to Section 2.11-Traffic Control, Rules and Requirements for Construction on Railway Property, SCRRA Form No. 37 for additional requirements.

13. Emergency Telephone Numbers

The Contractor must immediately contact SCRRA in case of accidents, personal injury, defect in track, bridge or signals, or any unusual condition, which may affect the safe operation of the railroads. The following are SCRRA's emergency numbers.

Metrolink Chief Dispatcher	(909) 593-0661	or	(888)
446-9715			
Metrolink Sheriff's Dispatcher			
(323) 563-5280			
Signal emergencies and grade crossing problems			(888) 446-9720
Signal and Communications Cable Location			(909)
392-8476			

14. Notices

Except as otherwise provided in this agreement, all notices, statements, demands, approvals, or other communications to be given under or pursuant to this agreement will be in writing, addressed to the parties at their respective addresses as provided below, and will be delivered in person, or by certified or registered mail, postage paid, or by telegraph or cable, charges pre-paid.

SCRRA: Manager Public Projects
Southern California Regional Rail Authority (SCRRA)
700 South Flower Street, Suite 2600
Los Angeles, CA 90017-4101

Attn: Right of Way Engineer

The Contractor hereby agrees to the terms as set forth in this agreement, and hereby acknowledges receipt of this agreement and of the insurance certificate forms (**Exhibits A & B**) herein provided.

(Name of Contractor)

By: _____
(Signature)

(Address)

(Print Name)

(Title)

(Telephone)

(Contractor's License No.)

(Fax)

Receipt of the foregoing agreement and certificates of insurance furnished by the Contractor are hereby acknowledged
this _____ day of _____ 200_____

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY

By: _____
(Insurance Coordinator
Projects)

By: _____
(Manager Public)

[Approved As To Form By Legal Counsel]

EXHIBIT "A"

INSURANCE REQUIREMENTS FOR RIGHT OF ENTRY AGREEMENTS

Contractor shall procure and maintain for the duration of the contract insurance against claims for injuries to persons or damages to Property which may arise from or in connection with the performance of the work by the Contractor, his agents, representatives, employees or subcontractors.

1. Minimum Scope of Insurance

Coverage shall be at least as broad as:

- ☒ Insurance Services Office Commercial General Liability coverage (occurrence form CG 0001).
- ☒ Insurance Services Office form No. CA 0001 (Ed. 1/87) covering Auto. Liability, code 1(any auto).
- ☒ Worker's Compensation insurance as required by the State of CA. & Employer's Liability Insurance.
- ☐ Course of Construction insurance form providing coverage for "all risks" of loss.
- ☐ Property insurance against all risks of loss to any tenant improvements or betterment.
- ☐ Contractor's Pollution Liability

2. Minimum Limits of Insurance

Contractor shall maintain limits no less than:

- ☒ General Liability: \$2,000,000 per occurrence for bodily injury, personal injury and Property damage. If Commercial General Liability Insurance or other form with a general aggregate limit is used, either the general aggregate limit shall apply separately to this project/location or the general aggregate limit shall be twice the required occurrence limit.
- ☒ Automobile Liability: \$1,000,000 per accident for bodily injury and Property damage.
- ☒ Employer's Liability: \$1,000,000 per accident for bodily injury or disease.
- ☐ Course of Construction: Completed value of the project..
- ☐ Property Insurance: Full replacement cost with no coinsurance penalty provision.
- ☐ Contractor's Pollution Liability: \$1,000,000 per occurrence/\$2,000,000 annual aggregate

3. Certificate Holder/Additional Insured

Certificate holder and/or insured will be the following:

- ☒ Southern California Regional Rail/Authority (SCRRA)

Additionally Insured will be the following:

- | | |
|---|---|
| <input checked="" type="checkbox"/> Los Angeles County Metropolitan Trans. Auth. (MTA) (BNSF) | <input type="checkbox"/> Burlington Northern Santa Fe Corporation |
| <input type="checkbox"/> Orange County Transportation Authority (OCTA) Company (UPRR) | <input checked="" type="checkbox"/> Union Pacific Railroad |
| <input type="checkbox"/> Riverside County Transportation Commission (RCTC) (Amtrak) | <input checked="" type="checkbox"/> National Railroad Passenger Corporation |
| <input type="checkbox"/> San Bernardino Associated Government (SANBAG) | <input type="checkbox"/> Others |
| <input type="checkbox"/> Ventura County Transportation Commission (VCTC) | |

4. Railroad Protective Liability Insurance

☐ Railroad Protective Liability Insurance

The Contractor shall provide, with respect to the operations they or any of their Subcontractors perform on the Property as per criteria shown in "Rules and Requirements for Construction on Railway Property", Railroad Protective Liability Insurance, AAR-AASHTO (ISO/RIMA) in the name of the railroads and Member Agencies shown in Section 3 above.

Insured:

The policy shall have limits of liability of not less than **\$2 million per occurrence**, combined single limit, for coverage and for losses arising out of injury to or death of all persons, and for physical loss or damage to or destruction of Property, including the loss of use thereof. A **\$6 million annual aggregate** shall apply. If coverage is provided on the London claims-made form, the following provisions shall apply:

- A. The limits of liability shall be not less than \$3 million per occurrence, combined single limit. A \$9 million aggregate may apply.
- B. Declarations item 6, extended claims made date, shall allow an extended claims made period no shorter than the length of the original policy period plus one year.
- C. If equivalent, or better, wording is not contained in the policy form, the following endorsement must be included:

It is agreed that "physical damage to Property" means direct and accidental loss of or damage to rolling stock and their contents, mechanical construction equipment or motive power equipment, railroad tracks, roadbed, categories, signals, bridges or buildings.

For certain low-hazard activity such as minor station maintenance, repair or construction; bridge painting; overhead fiber optic cables crossing; etc., Contractor may request that the SCRRA and Member Agency waive the requirement to provide the Railroad Protective Liability Insurance, in exchange for a fee. The waiver fee shall be established by the Risk Management Department.

If the exposure to the track is physically separated by a building, floor, or a continuous fence (no thoroughfares) and the employees of the Contractor are explicitly notified that they are not permitted to have any contact with the track, the Railroad Protective Liability Insurance requirement may be waived by SCRRA's Manager Public Projects or his/her designated representative.

5. Deductibles and Self-Insured Retention's

Any deductibles or self-insured retentions must be declared to and approved by SCRRA and Member Agency. At the option of SCRRA, either: the insurer shall reduce or eliminate such deductibles or self-insured retention's as respects SCRRA and Member Agency, its officials and employees or the Contractor shall procure a bond guaranteeing payment of losses and related investigations, claim administration and defense expenses.

6. Other Insurance Provisions

The General Liability and Automobile Liability policies are to contain, or be endorsed to contain, the following provisions:

- A. SCRRA and Member Agency, its subsidiaries, officials and employees are to be covered as insured as respects: liability arising out of activities performed by or on behalf of the Contractor; premises owned, occupied or used by the Contractor, or automobiles owned, leased, hired or borrowed by the Contractor. The coverage shall contain no special limitations on the scope of protection afforded to SCRRA and Member Agency, its subsidiaries, officials and employees.

- B. For any claims related to this project, the Contractor's insurance coverage shall be primary insurance as respects SCRRA and Member Agency, its subsidiaries, officials and employees. Any insurance or self-insurance maintained by SCRRA and Member Agency, its subsidiaries, officials and employees shall be excess of the Contractor's insurance and shall not contribute with it.
- C. Any failure to comply with reporting or other provisions of the policies including breaches of warranties shall not effect coverage provided to SCRRA and Member Agency, its subsidiaries, officials and employees.
- D. The Contractor insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.
- E. Each insurance policy required by this clause shall be endorsed to state that coverage shall not be suspended, voided, canceled by either party, reduced in coverage or in limits except after thirty (30) days' prior written notice by certified mail, return receipt requested, has been given to SCRRA and/or Member Agency.

Course of Construction policies shall contain the following provisions:

- A. SCRRA and Member Agency shall be named as loss payee.
- B. The insurer shall waive all rights subrogation against SCRRA and Member Agency.

7. Acceptability of Insurers

Insurance is to be placed with insurers with a current A.M. Best's rating of no less than A:VII, unless otherwise approved by SCRRA and Member Agency.

8. Verification of Coverage

Contractor shall furnish SCRRA with original endorsements effecting coverage required by this clause. The endorsements are to be signed by a person authorized by that insurer to bind coverage on its behalf. The endorsements are to be on forms provided by SCRRA. All endorsements are to be received and approved by SCRRA before work commences. As an alternative to SCRRA's forms, the Contractor's insurer may provide complete, certified copies of all required insurance policies, including endorsements effecting the coverage required by these specifications.

9. Subcontractors

Contractor shall include all subcontractors as insured under its policies or shall furnish separate certificates and endorsements for each subcontractor. All coverage for subcontractors shall be subject to all of the requirements stated herein.

10. Train Services

Approximate daily train traffic is 74 passenger trains and 17 freight trains.

11. Submittal

The original insurance policy (s) shall be submitted to:

Manager Public Projects
Southern California Regional Rail Authority (SCRRA)
700 South Flower Street, Suite 2600
Los Angeles, CA 90017-4101

Attn: Right of Way Engineer

EXHIBIT "B"
RAILROAD PROTECTIVE LIABILITY POLICY
DECLARATION

POLICY

Insurance Company:

Policy Number:

Policy Period: From: _____ To: _____ 12:01am Standard time at location

NAMED INSURED AND MAILING ADDRESS

Insured:

- ☒ Southern California Regional Rail Authority (SCRRA)
 700 South Flower Street, Suite 2600 Los Angeles, CA 90017-4101

Additionally Insured:

- | | |
|--|--|
| <input checked="" type="checkbox"/> Los Angeles County Metropolitan Trans. Auto. (MTA) | <input type="checkbox"/> Burlington Northern Santa Fe Corporation (BNSF) |
| <input type="checkbox"/> Orange County Transportation Authority (OCTA) | <input checked="" type="checkbox"/> Union Pacific Railroad Company (UPRR) |
| <input type="checkbox"/> Riverside County Transportation Commission (RCTC) | <input checked="" type="checkbox"/> National Railroad Passenger Corporation (Amtrak) |
| <input type="checkbox"/> San Bernardino Associated Governments (SANBAG) | <input type="checkbox"/> Others |
| <input type="checkbox"/> Ventura County Transportation Commission (VCTC) | |

LIMITS OF INSURANCE

Aggregate Limit:

Each Occurrence Limit:

DESCRIPTION OF WORK AND JOB LOCATION(S)

NAME AND ADDRESS OF DESIGNATED CONTRACTOR

NAME AND ADDRESS OF INVOLVED GOVERNMENT AUTHORITY OR OTHER CONTRACTING PARTY

PREMIUM

Contract Cost

Premium Base

Rate per 1,000 of

Advance Premium _____

FORM OF ENDORSEMENT

Title

Number

COUNTERSIGNATURE

Countersigned by _____ Date _____
 (Authorized Representative)

EXHIBIT 'B'						
CERTIFICATE OF INSURANCE, Southern California Regional Rail Authority (SCRRA)						
PRODUCER		THIS CERTIFICATE OF INSURANCE IS NOT AN INSURANCE POLICY AND DOES NOT AMEND, EXTEND OR ALTER THIS COVERAGE AFFORDED BY THE POLICY BELOW.				
INSURED		COMPANIES AFFORDING COVERAGE COMPANY A LETTER COMPANY B LETTER COMPANY C LETTER COMPANY D LETTER COMPANY E LETTER				
THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED NAMED ABOVE FOR THE POLICY PERIOD INDICATED, NOTWITHSTANDING ANY REQUIREMENTS, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN. THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.						
CO LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	LIMITS	
	GENERAL LIABILITY <input type="checkbox"/> COMMERCIAL GENERAL LIABILITY <input type="checkbox"/> CLAIMS MADE OCCUR. <input type="checkbox"/> OWNER'S & CONTRACTOR'S PROT. <input type="checkbox"/> OTHER				GENERAL AGGREGATE PRODUCTS-COMP/OP AGG. PERSONAL & ADV. INJURY EACH OCCURRENCE FIRE DAMAGE (Any one fire) MED. EXPENSE (Any one person)	\$ \$ \$ \$ \$
	AUTOMOBILE LIABILITY <input type="checkbox"/> ANY AUTO ALL OWNED <input type="checkbox"/> SCHEDULED AUTOS <input type="checkbox"/> HIRED AUTOS <input type="checkbox"/> NON-OWNED AUTOS <input type="checkbox"/> GARAGE LIABILITY				COMBINED SINGLE LIMIT BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE	\$ \$ \$ \$
	EXCESS LIABILITY <input type="checkbox"/> UMBRELLA FORM <input type="checkbox"/> OTHER THAN UMBRELLA FORM				EACH OCCURRENCE AGGREGATE	\$ \$
	PROPERTY INSURANCE <input type="checkbox"/> COURSE OF CONSTRUCTION				AMOUNT OF INSURANCE	\$
	WORKER'S COMPENSATION AND EMPLOYER'S LIABILITY				STATUTORY LIMITS EACH ACCIDENT DISEASE-POLICY LIMIT DISEASE-EACH EMPLOYEE	\$ \$ \$
DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/SPECIAL ITEMS						

THE FOLLOWING PROVISIONS APPLY:

1. None of the above-described policies will be cancelled, limited in scope of coverage or non renewed until after 30 days' written notice has been given to SCRRRA at the address indicated below.
2. As respects operations of the named insured performed on behalf of SCRRRA, the following are added as additional insured on all liability insurance policies listed above: SCRRRA, its Member Agencies, Operating Railroads, its subsidiaries, officials and employees.
3. It is agreed that any insurance of self-insurance maintained by SCRRRA will apply in excess of and not contribute with, the insurance described above.
4. SCRRRA is named a loss payee on the property insurance policies described above, if any.
5. All rights of subrogation under the property insurance policy listed above have been waived against SCRRRA.
6. Any failure by the insured to comply with reporting or other provisions of the policies including breaches of warranties shall not affect coverage provided to SCRRRA, its Member Agencies, its subsidiaries, officials and employees.
7. The worker's compensation insurer named above, if any, agrees to waive all rights of subrogation against SCRRRA for injuries to employees of the insured resulting from work for SCRRRA or use of Member Agencies premises or facilities.

CERTIFICATE HOLDER/ADDITIONAL INSURED

☒ Southern California Regional Rail Authority (SCRRRA)
700 South Flower Street, Suite 2600, Los Angeles, CA 90086-4101

☐ MTA ☐ OCTA ☐ RCTC
☐ SANBAG ☐ VCTC
☐ AMTRAK ☐ BNSF ☐ UPRR

AUTHORIZED REPRESENTATIVE
SIGNATURE _____

TITLE _____

PHONE NO. _____

GENERAL SAFETY REGULATIONS FOR CONSTRUCTION/MAINTENANCE ACTIVITY ON RAILWAY PROPERTY

A. GENERAL

1. Safety is of first importance in the discharge of duty.
2. These safety regulations govern your activities while on SCRRA property regardless if on or off duty.
3. Use or possession of unauthorized radio equipment is forbidden. Use of personal radios, portable tape cassette players or portable disc or record players while working is prohibited.
4. Horseplay, physical altercations, running or jumping are forbidden.
5. Firearms or other deadly weapons, including knives with a blade in excess of three inches are prohibited on SCRRA or Member Agency Property.
6. Work on public streets, roadway crossings, and highway bridges should be performed with due regard for the convenience and safety of the public.
7. All employees must look in both directions before crossing any track or roadway. Crossing tracks with equipment is prohibited unless authorized by SCRRA.
8. Only authorized employees are allowed on engines, cars caboose, track cars or other railroad equipment.

B. PERSONAL PROTECTIVE EQUIPMENT

1. All employees working on SCRRA or Member Agency Property will be required to wear the following protective equipment (except in offices or motor vehicles):
 - a. Hard hats which meet the requirements of ANSI Z89.1 or ANSI Z89.2, as specified by CAL/OSHA and/or Fed/OSHA. Metallic (metal) hard hats shall not be worn on any SCRRA project.
 - b. Eye Protection which meets the requirements of ANSI Z87.1 will be worn while on SCRRA property. Eye Protection with side shields, which meet the requirements of ANSI Z87.1 for those employees or contractors falling under 49 CFR 214. See Bridge Worker Safety Policy.
 - c. Orange Safety vests with reflective tape.
 - d. High-top leatherwork boots. Steel toe boots are required for those employees who fall under 49 CFR 214. See SCRRA Bridge worker Safety Policy.
 - e. Must use appropriate gloves when working on track or signal systems.
 - f. Grinding operations require full-face shield.

C. HOUSEKEEPING

1. Keeping premises, tools and equipment in a clean and orderly condition is essential to safety and is the responsibility of each employee.
2. Employee must be aware of areas with spilled oil or grease and apply sand or an equivalent (approved) material to minimize slipping hazards.
3. Flammable materials, caustics, acids and solvents must be stored in designated areas and in containers, which are provided for them.

4. Contractor is responsible for restoring the property to its previous condition, making repairs to fences, gates, or buildings damaged or removed by Contractor or its forces.

D. ELECTRICAL

1. Electric wires must be considered live at all times. Employee shall not depend on the insulation of wires for their safety. Employee must keep away from all overhead wires and underground wires they may come in contact with.
2. Employee must not place any metal objects across rails, which could shunt electrical circuits.

E. HAND TOOLS

1. Employees must inspect tools, machinery and equipment for defects before using.
2. Employees must use all tools and appliances in the manner intended and for the purpose designed and only those employees qualified and authorized to operate equipment and machinery can do so in the performance of duty.
3. Sharp-edge tools are to be sheathed at all times while being stored or transported.

F. ACCIDENT AND INJURY

1. When persons are injured, everything possible must be done for their care.
2. Accidents, personal injury to Employee, defects in track, bridges or signals or any unusual condition which may affect the safe and efficient operation of the SCRRA's and its Operating Railroad's operations, must be reported immediately to the Project Manager or Inspector.
3. Employees must exercise care to prevent injury to themselves or others. They must be alert and attentive at all times when performing their work and plan their work to avoid injury.
4. In case of personal injury, loss of life, or damage to property, the Foreman (Supervisor or others in charge) must immediately secure the names, addresses and occupations of all persons involved, including all persons at the scene regardless of whether these persons admit knowing anything about the accident. This information should be included in reports covering each occurrence.
5. If an accident causes personal injury or death, all tools, machinery and other equipment involved, including premises where such accident occurred, must be promptly inspected by the Foreman or by other competent inspectors. A report of such inspection, stating the conditions found and names of persons making the inspection, must be promptly forwarded to SCRRA and the supervising officer of person making the inspection.
6. Information concerning accidents or personal injuries occurring to persons who are not Employee must not be given to anyone except authorized representatives of the SCRRA or an officer of the law.
7. Prior to starting work, each crew will have available on site, a list of emergency phone numbers (ambulance, police, SCRRA's and/or its operating railroad's representative and the Central Control Facility) to contact if necessary.
8. Each crew will possess and maintain at each work site, an OSHA approved first-aid (36-unit minimum).

G. RAILROAD SAFETY FOR NON-RAILROAD EMPLOYEES

1. Foremen working on or about tracks are responsible for the safety of their crews and must guard their crews against impending danger or injury. They shall bear in mind that safety is the first and most important consideration. Foremen must have knowledge of train and engines and that protection, as required by regulation, has been furnished.
2. The Contractor must request and arrange for an inspector and/or other protective services from SCRRA authorized representative's five days before the work, for the following conditions:

- a. Protective Services for work around the railroad include form "B's" track and time and work and time. This protection can only be obtained by a qualified railroad inspector.

- When Contractor's employee(s) and equipment(s) are within twenty (20) feet of the nearest rail.
- When any part of any equipment is standing or being operated within or adjacent to the Property, or when any erection or construction activities are in progress within such limits, regardless of elevation above or below track.
- For any excavation below the elevation of track sub-grade if, in the opinion of SCRRA or Member Agency's representative, track or other Property may be subject to settlement or movement.
- For any clearing, grubbing, grading, or blasting proximity to the Property which, in the opinion of SCRRA or Member Agency's representative, may endanger the property or operations.

For any street construction and maintenance activities requiring temporary work area traffic control which may affect or create unsafe conditions for employees, public, trains and vehicles.

3. SCRRA or Member Agency will furnish such employee or other protective services when, in the opinion of SCRRA's representative, the property, including but not limited to tracks, buildings, signals, wire lines or pipelines, may be endangered.
4. A job briefing (meeting among all of the employees who are involved or will be involved in particular task or job at the same work site), conforming to FRA, s regulations concerning roadway work protection, must be attended by contractor's employees before performing any task and/or any employee fouls (an individual or an equipment's in such proximity of a track that they would be struck by a moving train or on- track equipment) any track. The job briefing will include designation of an employee in charge, type of protection, limits and time of the protection, how to clear for trains and identify area of clearing.
5. Any SCRRA authorized work within twenty (20) feet of the nearest rail must be stopped, with equipment in the clear, when trains are approaching. All employees must stand back at least twenty-five (25) feet from the tracks. If it is not possible to stand 25 feet back, then employee must stand back as far as possible.
6. Movable equipment or vehicles will be:
 - operated by authorized employee only
 - operated to avoid damage to equipment or injury to occupant due to condition of route traveled account presence of concealed obstruction or holes.
 - properly secured and clear of tracks when equipment stands idle
 - parked in such a manner as not to impair vision from public roads or track right-of-way
7. Movable equipment or vehicle will not be:
 - left unattended in close proximity to railroad tracks and must be secured when left unattended
 - stored or left temporarily near a highway grade crossing in such a manner as to interfere with the sight distances of persons approaching that crossing
 - set in motion until it is known that the way is clear
 - operated in a manner to endanger life, limb or property
 - operated when safety appliance or device is missing, damaged, and inoperative or not functioning as designed

8. Equipment Operator's responsibility

- When equipment is left unattended, motor must be topped, ignition must be locked, parking or hand brake must be securely set, keys must be in possession of operator or other authorized Employee, wheels must be securely blocked on grades, and equipment should be secured in highly visible area.
- While train engine or cars are passing, brakes or other mechanism for securing rotating machinery must be used to prevent possibility of rotating parts moving; all buckets on shovels or cranes must be lowered to rest; and those without buckets must have their load line tightened to prevent movement.
- Operators are responsible for seeing that unauthorized persons are not carried on equipment and must know that persons qualified to be on equipment are properly positioned before movement is made.

9. Employees must not cross tracks by going underneath cars/engines or between cars coupled together.
10. Employees must not step on rails, frogs or switches and must watch their footing to avoid falling slipping or tripping. Personnel must not step on moving parts of track switches.
11. Employees must not make any move toward an approaching train with machinery that would cause the engineer to believe the track was going to be fouled.
12. Before starting work on or about the tracks, crews must have an understanding as to where they will go when necessary to clear for trains.
13. Trains are traveling faster than they appear and are relatively quiet. Moving trains are to be expected on any track at any time from either direction. Engines can push or pull a train. Employee should not rely on past experiences to determine train schedule. Train schedules are unpredictable and trains are subject to schedule change.

END

SECTION 14 FEDERAL REQUIREMENTS FOR FEDERAL-AID CONSTRUCTION PROJECTS

GENERAL.—The work herein proposed will be financed in whole or in part with Federal funds, and therefore all of the statutes, rules and regulations promulgated by the Federal Government and applicable to work financed in whole or in part with Federal funds will apply to such work. The "Required Contract Provisions, Federal-Aid Construction Contracts, "Form FHWA 1273, are included in this Section 14. Whenever in said required contract provisions references are made to "SHA contracting officer", "SHA resident engineer", or "authorized representative of the SHA", such references shall be construed to mean "Engineer" as defined in Section 1-1.18 of the Standard Specifications.

PERFORMANCE OF PREVIOUS CONTRACT.—In addition to the provisions in Section II, "Nondiscrimination," and Section VII, "Subletting or Assigning the Contract," of the required contract provisions, the Contractor shall comply with the following:

The bidder shall execute the CERTIFICATION WITH REGARD TO THE PERFORMANCE OF PREVIOUS CONTRACTS OR SUBCONTRACTS SUBJECT TO THE EQUAL OPPORTUNITY CLAUSE AND THE FILING OF REQUIRED REPORTS located in the proposal. No request for subletting or assigning any portion of the contract in excess of \$10,000 will be considered under the provisions of Section VII of the required contract provisions unless such request is accompanied by the CERTIFICATION referred to above, executed by the proposed subcontractor.

NON-COLLUSION PROVISION.—The provisions in this section are applicable to all contracts except contracts for Federal Aid Secondary projects.

Title 23, United States Code, Section 112, requires as a condition precedent to approval by the Federal Highway Administrator of the contract for this work that each bidder file a sworn statement executed by, or on behalf of, the person, firm, association, or corporation to whom such contract is to be awarded, certifying that such person, firm, association, or corporation has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the submitted bid. A form to make the non-collusion affidavit statement required by Section 112 as a certification under penalty of perjury rather than as a sworn statement as permitted by 28, USC, Sec. 1746, is included in the proposal.

PARTICIPATION BY MINORITY BUSINESS ENTERPRISES IN SUBCONTRACTING.—Part 23, Title 49, Code of Federal Regulations applies to this Federal-aid project. Pertinent sections of said Code are incorporated in part or in its entirety within other sections of these special provisions.

Schedule B—Information for Determining Joint Venture Eligibility

(This form need not be filled in if all joint venture firms are minority owned.)

1. Name of joint venture _____
2. Address of joint venture _____
3. Phone number of joint venture _____
4. Identify the firms which comprise the joint venture. (The MBE partner must complete Schedule A.) _____

 - a. Describe the role of the MBE firm in the joint venture. _____
 - b. Describe very briefly the experience and business qualifications of each non-MBE joint venturer: _____

5. Nature of the joint venture's business _____
6. Provide a copy of the joint venture agreement.
7. What is the claimed percentage of MBE ownership? _____
8. Ownership of joint venture: (This need not be filled in if described in the joint venture agreement, provided by question 6.).
 - a. Profit and loss sharing.
 - b. Capital contributions, including equipment.
 - c. Other applicable ownership interests.

9. Control of and participation in this contract. Identify by name, race, sex, and "firm" those individuals (and their titles) who are responsible for day-to-day management and policy decision making, including, but not limited to, those with prime responsibility for:

a. Financial decisions _____

b. Management decisions, such as:

(1) Estimating _____

(2). Marketing and sales _____

(3). Hiring and firing of management personnel _____

(4) Purchasing of major items or supplies _____

c. Supervision of field operations _____

Note.—If, after filing this Schedule B and before the completion of the joint venture's work on the contract covered by this regulation, there is any significant change in the information submitted, the joint venture must inform the grantee, either directly or through the prime contractor if the joint venture is a subcontractor.

Affidavit

"The undersigned swear that the foregoing statements are correct and include all material information necessary to identify and explain the terms and operation of our joint venture and the intended participation by each joint venturer in the undertaking. Further, the undersigned covenant and agree to provide to grantee current, complete and accurate information regarding actual joint venture work and the payment therefor and any proposed changes in any of the joint venture arrangements and to permit the audit and examination of the books, records and files of the joint venture, or those of each joint venturer relevant to the joint venture, by authorized representatives of the grantee or the Federal funding agency. Any material misrepresentation will be grounds for terminating any contract which may be awarded and for initiating action under Federal or State laws concerning false statements."

_____ Name of Firm	_____ Name of Firm
_____ Signature	_____ Signature
_____ Name	_____ Name
_____ Title	_____ Title
_____ Date	_____ Date

Date _____

State of _____

County of _____

On this ____ day of _____, 19 __, before me appeared (Name) _____, to me personally known, who, being duly sworn, did execute the foregoing affidavit, and did state that he or she was properly authorized by (Name of firm) _____ to execute the affidavit and did so as his or her free act and deed.

Notary Public _____

Commission expires _____

[Seal]

Date _____

State of _____

County of _____

On this ____ day of _____, 19 __, before me appeared (Name) _____ to me personally known, who, being duly sworn, did execute the foregoing affidavit, and did state that he or she was properly authorized by (Name of firm) _____ to execute the affidavit and did so as his or her free act and deed.

Notary Public _____

Commission expires _____

[Seal]

**REQUIRED CONTRACT PROVISIONS
FEDERAL-AID CONSTRUCTION CONTRACTS**

I. GENERAL

1. These contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.
2. Except as otherwise provided for in each section, the contractor shall insert in each subcontract all of the stipulations contained in these Required Contract Provisions, and further require their inclusion in any lower tier subcontract or purchase order that may in turn be made. The Required Contract Provisions shall not be incorporated by reference in any case. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with these Required Contract Provisions.
3. A breach of any of the stipulations contained in these Required Contract Provisions shall be sufficient grounds for termination of the contract.
4. A breach of the following clauses of the Required Contract Provisions may also be grounds for debarment as provided in 29 CFR 5.12:

Section I, paragraph 2;
Section IV, paragraphs 1, 2, 3, 4, and 7;
Section V, paragraphs 1 and 2a through 2g.

5. Disputes arising out of the labor standards provisions of Section IV (except paragraph 5) and Section V of these Required Contract Provisions shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the U.S. Department of Labor (DOL) as set forth in 29 CFR 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the DOL, or the contractor's employees or their representatives.
6. **Selection of Labor:** During the performance of this contract, the contractor shall not:
 - a. discriminate against labor from any other State, possession, or territory of the United States (except for employment preference for Appalachian contracts, when applicable, as specified in Attachment A), or
 - b. employ convict labor for any purpose within the limits of the project unless it is labor performed by convicts who are on parole, supervised release, or probation.

II. NONDISCRIMINATION

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$10,000 or more.)

1. **Equal Employment Opportunity:** Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630, and 41 CFR 60) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The Equal Opportunity Construction Contract Specifications set forth under 41 CFR 60-4.3 and the provisions of the American Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:
 - a. The contractor will work with the State highway agency (SHA) and the Federal Government in carrying out EEO obligations and in their review of his/her activities under the contract.
 - b. The contractor will accept as his operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall

include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, preapprenticeship, and/or on-the-job training."

2. **EEO Officer:** The contractor will designate and make known to the SHA contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active contractor program of EEO and who must be assigned adequate authority and responsibility to do so.
3. **Dissemination of Policy:** All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:
 - a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.
 - b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.
 - c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minority group employees.
 - d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.
 - e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.
4. **Recruitment:** When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minority groups in the area from which the project work force would normally be derived.
 - a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minority group applicants. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority group applicants may be referred to the contractor for employment consideration.
 - b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, he is expected to observe the provisions of that agreement to the extent that the system permits the contractor's compliance with EEO contract provisions. (The DOL has held that where implementation of such agreements have the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Executive Order 11246, as amended.)
 - c. The contractor will encourage his present employees to refer minority group applicants for employment. Information and procedures with regard to referring minority group applicants will be discussed with employees.
5. **Personnel Actions:** Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:
 - a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

- b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.
 - c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.
 - d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with his obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of his avenues of appeal.
6. Training and Promotion:
- a. The contractor will assist in locating, qualifying, and increasing the skills of minority group and women employees, and applicants for employment.
 - b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision.
 - c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.
 - d. The contractor will periodically review the training and promotion potential of minority group and women employees and will encourage eligible employees to apply for such training and promotion.
7. **Unions:** If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use his/her best efforts to obtain the cooperation of such unions to increase opportunities for minority groups and women within the unions, and to effect referrals by such unions of minority and female employees. Actions by the contractor either directly or through a contractor's association acting as agent will include the procedures set forth below:
- a. The contractor will use best efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minority group members and women for membership in the unions and increasing the skills of minority group employees and women so that they may qualify for higher paying employment.
 - b. The contractor will use best efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.
 - c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the SHA and shall set forth what efforts have been made to obtain such information.
 - d. In the event the union is unable to provide the contractor with a reasonable flow of minority and women referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minority group persons and women. (The DOL has held that it shall be no excuse that the union with which the contractor has a collective bargaining agreement providing for exclusive referral failed to refer minority employees.) In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the SHA.

8. **Selection of Subcontractors, Procurement of Materials and Leasing of Equipment:** The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment.
- a. The contractor shall notify all potential subcontractors and suppliers of his/her EEO obligations under this contract.
 - b. Disadvantaged business enterprises (DBE), as defined in 49 CFR 23, shall have equal opportunity to compete for and perform subcontracts which the contractor enters into pursuant to this contract. The contractor will use his best efforts to solicit bids from and to utilize DBE subcontractors or subcontractors with meaningful minority group and female representation among their employees. Contractors shall obtain lists of DBE construction firms from SHA personnel.
 - c. The contractor will use his best efforts to ensure subcontractor compliance with their EEO obligations.
9. **Records and Reports:** The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following completion of the contract work and shall be available at reasonable times and places for inspection by authorized representatives of the SHA and the FHWA.
- a. The records kept by the contractor shall document the following:
 - (1) The number of minority and non-minority group members and women employed in each work classification on the project;
 - (2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women;
 - (3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minority and female employees; and
 - (4) The progress and efforts being made in securing the services of DBE subcontractors or subcontractors with meaningful minority and female representation among their employees.
 - b. The contractors will submit an annual report to the SHA each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form FHWA-1391. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data.

III. NONSEGREGATED FACILITIES

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$10,000 or more.)

- a. By submission of this bid, the execution of this contract or subcontract, or the consummation of this material supply agreement or purchase order, as appropriate, the bidder, Federal-aid construction contractor, subcontractor, material supplier, or vendor, as appropriate, certifies that the firm does not maintain or provide for its employees any segregated facilities at any of its establishments, and that the firm does not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The firm agrees that a breach of this certification is a violation of the EEO provisions of this contract. The firm further certifies that no employee will be denied access to adequate facilities on the basis of sex or disability.
- b. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating areas, time clocks, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive, or are, in fact, segregated on the basis of race, color, religion, national origin, age or disability, because of habit, local custom, or otherwise. The only exception will be for the disabled when the demands for accessibility override (e.g. disabled parking).

- c. The contractor agrees that it has obtained or will obtain identical certification from proposed subcontractors or material suppliers prior to award of subcontracts or consummation of material supply agreements of \$10,000 or more and that it will retain such certifications in its files.

IV. PAYMENT OF PREDETERMINED MINIMUM WAGE

(Applicable to all Federal-aid construction contracts exceeding \$2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural minor collectors, which are exempt.)

1. General:

- a. All mechanics and laborers employed or working upon the site of the work will be paid unconditionally and not less often than once a week and without subsequent deduction or rebate on any account [except such payroll deductions as are permitted by regulations (29 CFR 3)] issued by the Secretary of Labor under the Copeland Act (40 U.S.C. 276c) the full amounts of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment. The payment shall be computed at wage rates not less than those contained in the wage determination of the Secretary of Labor (hereinafter "the wage determination") which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor or its subcontractors and such laborers and mechanics. The wage determination (including any additional classifications and wage rates conformed under paragraph 2 of this Section IV and the DOL poster (WH-1321) or Form FHWA-1495) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers. For the purpose of this Section, contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act (40 U.S.C. 276a) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of Section IV, paragraph 3b, hereof. Also, for the purpose of this Section, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in paragraphs 4 and 5 of this Section IV.
- b. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein, provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed.
- c. All rulings and interpretations of the Davis-Bacon Act and related acts contained in 29 CFR 1, 3, and 5 are herein incorporated by reference in this contract.

2. Classification:

- a. The SHA contracting officer shall require that any class of laborers or mechanics employed under the contract, which is not listed in the wage determination, shall be classified in conformance with the wage determination.
- b. The contracting officer shall approve an additional classification, wage rate and fringe benefits only when the following criteria have been met:
 - (1) the work to be performed by the additional classification requested is not performed by a classification in the wage determination;
 - (2) the additional classification is utilized in the area by the construction industry;
 - (3) the proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination; and
 - (4) with respect to helpers, when such a classification prevails in the area in which the work is performed.
- c. If the contractor or subcontractors, as appropriate, the laborers and mechanics (if known) to be employed in the additional classification or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the DOL, Administrator of the Wage and Hour Division, Employment Standards Administration, Washington, D.C. 20210. The Wage and Hour Administrator, or an authorized

representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

- d. In the event the contractor or subcontractors, as appropriate, the laborers or mechanics to be employed in the additional classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. Said Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary
- e. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph 2c or 2d of this Section IV shall be paid to all workers performing work in the additional classification from the first day on which work is performed in the classification.

3. Payment of Fringe Benefits:

- a. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor or subcontractors, as appropriate, shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly case equivalent thereof.
- b. If the contractor or subcontractor, as appropriate, does not make payments to a trustee or other third person, he/she may consider as a part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, provided, that the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

4. Apprentices and Trainees (Programs of the U.S. DOL) and Helpers:

- a. Apprentices:
 - (1) Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the DOL, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau, or if a person is employed in his/her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State apprenticeship agency (where appropriate) to be eligible for probationary employment as an apprentice.
 - (2) The allowable ratio of apprentices to journeyman-level employees on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any employee listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate listed in the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor or subcontractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman-level hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

- (3) Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator for the Wage and Hour Division determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.
- (4) In the event the Bureau of Apprenticeship and Training, or a State apprenticeship agency recognized by the Bureau, withdraws approval of an apprenticeship program, the contractor or subcontractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the comparable work performed by regular employees until an acceptable program is approved.

b. Trainees:

- (1) Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the DOL, Employment and Training Administration.
- (2) The ratio of trainees to journeyman-level employees on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.
- (3) Every trainee must be paid at not less than the rate specified in the approved program for his/her level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman-level wage rate on the wage determination which provides for less than full fringe benefits for apprentices, in which case such trainees shall receive the same fringe benefits as apprentices.
- (4) In the event the Employment and Training Administration withdraws approval of a training program, the contractor or subcontractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Helpers:

Helpers will be permitted to work on a project if the helper classification is specified and defined on the applicable wage determination or is approved pursuant to the conformance procedure set forth in Section IV.2. Any worker listed on a payroll at a helper wage rate, who is not a helper under an approved definition, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed.

5. Apprentices and Trainees (Programs of the U.S. DOT):

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

6. Withholding:

The SHA shall upon its own action or upon written request of an authorized representative of the DOL withhold, or cause to be withheld, from the contractor or subcontractor under this contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements which is held by the same prime contractor, as much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the SHA contracting officer may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

7. Overtime Requirements:

No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers, mechanics, watchmen, or guards (including apprentices, trainees, and helpers described in paragraphs 4 and 5 above) shall require or permit any laborer, mechanic, watchman, or guard in any workweek in which he/she is employed on such work, to work in excess of 40 hours in such workweek unless such laborer, mechanic, watchman, or guard receives compensation at a rate not less than one-and-one-half times his/her basic rate of pay for all hours worked in excess of 40 hours in such workweek.

8. Violation:

Liability for Unpaid Wages; Liquidated Damages: In the event of any violation of the clause set forth in paragraph 7 above, the contractor and any subcontractor responsible thereof shall be liable to the affected employee for his/her unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory) for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer, mechanic, watchman, or guard employed in violation of the clause set forth in paragraph 7, in the sum of \$10 for each calendar day on which such employee was required or permitted to work in excess of the standard work week of 40 hours without payment of the overtime wages required by the clause set forth in paragraph 7.

9. Withholding for Unpaid Wages and Liquidated Damages:

The SHA shall upon its own action or upon written request of any authorized representative of the DOL withhold, or cause to be withheld, from any monies payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph 8 above.

V. STATEMENTS AND PAYROLLS

(Applicable to all Federal-aid construction contracts exceeding \$2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural collectors, which are exempt.)

1. Compliance with Copeland Regulations (29 CFR 3):

The contractor shall comply with the Copeland Regulations of the Secretary of Labor which are herein incorporated by reference.

2. Payrolls and Payroll Records:

- a. Payrolls and basic records relating thereto shall be maintained by the contractor and each subcontractor during the course of the work and preserved for a period of 3 years from the date of completion of the contract for all laborers, mechanics, apprentices, trainees, watchmen, helpers, and guards working at the site of the work.
- b. The payroll records shall contain the name, social security number, and address of each such employee; his or her correct classification; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalent thereof the types described in Section 1(b)(2)(B) of the Davis Bacon Act); daily and weekly number of hours worked; deductions made; and actual wages paid. In addition, for Appalachian contracts, the payroll records shall contain a notation indicating whether the employee does, or

does not, normally reside in the labor area as defined in Attachment A, paragraph 1. Whenever the Secretary of Labor, pursuant to Section IV, paragraph 3b, has found that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1(b)(2)(B) of the Davis Bacon Act, the contractor and each subcontractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, that the plan or program has been communicated in writing to the laborers or mechanics affected, and show the cost anticipated or the actual cost incurred in providing benefits. Contractors or subcontractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprentices and trainees, and ratios and wage rates prescribed in the applicable programs.

- c. Each contractor and subcontractor shall furnish, each week in which any contract work is performed, to the SHA resident engineer a payroll of wages paid each of its employees (including apprentices, trainees, and helpers, described in Section IV, paragraphs 4 and 5, and watchmen and guards engaged on work during the preceding weekly payroll period). The payroll submitted shall set out accurately and completely all of the information required to be maintained under paragraph 2b of this Section V. This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents (Federal stock number 029-005-0014-1), U.S. Government Printing Office, Washington, D.C. 20402. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors.
- d. Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his/her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:
 - (1) that the payroll for the payroll period contains the information required to be maintained under paragraph 2b of this Section V and that such information is correct and complete;
 - (2) that such laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR 3;
 - (3) that each laborer or mechanic has been paid not less than the applicable wage rate and fringe benefits or cash equivalent for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.
- e. The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 2d of this Section V.
- f. The falsification of any of the above certifications may subject the contractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 231.
- g. The contractor or subcontractor shall make the records required under paragraph 2b of this Section V available for inspection, copying, or transcription by authorized representatives of the SHA, the FHWA, or the DOL, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the SHA, the FHWA, the DOL, or all may, after written notice to the contractor, sponsor, applicant, or owner, take such actions as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

VI. RECORD OF MATERIALS, SUPPLIES, AND LABOR

- 1. On all Federal-aid contracts on the National Highway System, except those which provide solely for the installation of protective devices at railroad grade crossings, those which are constructed on a force account or direct labor basis, highway beautification contracts, and contracts for which the total final construction cost for roadway and bridge is less than \$1,000,000 (23 CFR 635) the contractor shall:

- a. Become familiar with the list of specific materials and supplies contained in Form FHWA-47, "Statement of Materials and Labor Used by Contractor of Highway Construction Involving Federal Funds," prior to the commencement of work under this contract.
 - b. Maintain a record of the total cost of all materials and supplies purchased for and incorporated in the work, and also of the quantities of those specific materials and supplies listed on Form FHWA-47, and in the units shown on Form FHWA-47.
 - c. Furnish, upon the completion of the contract, to the SHA resident engineer on Form FHWA-47 together with the data required in paragraph 1b relative to materials and supplies, a final labor summary of all contract work indicating the total hours worked and the total amount earned.
2. At the prime contractor's option, either a single report covering all contract work or separate reports for the contractor and for each subcontract shall be submitted.

VII. SUBLETTING OR ASSIGNING THE CONTRACT

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the State. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635).
 - a. "Its own organization" shall be construed to include only workers employed and paid directly by the prime contractor and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor, assignee, or agent of the prime contractor.
 - b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid on the contract as a whole and in general are to be limited to minor components of the overall contract.
2. The contract amount upon which the requirements set forth in paragraph 1 of Section VII is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.
3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the SHA contracting officer determines is necessary to assure the performance of the contract.
4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the SHA contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the SHA has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

VIII. SAFETY: ACCIDENT PREVENTION

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the SHA contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.
2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the

Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 333).

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 333).

IX. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, the following notice shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

Notice To All Personnel Engaged On Federal-Aid Highway Projects

18 U.S.C. 1020 READS AS FOLLOWS:

"Whoever being an officer, agent, or employee of the United States, or any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined not more than \$10,000 or imprisoned not more than 5 years or both."

X. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$100,000 or more.)

By submission of this bid or the execution of this contract, or subcontract, as appropriate, the bidder, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any facility that is or will be utilized in the performance of this contract, unless such contract is exempt under the Clean Air Act, as amended (42 U.S.C. 1857 et seq., as amended by Pub.L. 91-604), and under the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq., as amended by Pub.L. 92-500), Executive Order 11738, and regulations in implementation thereof (40 CFR 15) is not listed, on the date of contract award, on the U.S. Environmental Protection Agency (EPA) List of Violating Facilities pursuant to 40 CFR 15.20.
2. That the firm agrees to comply and remain in compliance with all the requirements of Section 114 of the Clean Air Act and Section 308 of the Federal Water Pollution Control Act and all regulations and guidelines listed thereunder.
3. That the firm shall promptly notify the SHA of the receipt of any communication from the Director, Office of Federal Activities, EPA, indicating that a facility that is or will be utilized for the contract is under consideration to be listed on the EPA List of Violating Facilities.

4. That the firm agrees to include or cause to be included the requirements of paragraph 1 through 4 of this Section X in every nonexempt subcontract, and further agrees to take such action as the government may direct as a means of enforcing such requirements.

XI. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

1. Instructions for Certification - Primary Covered Transactions:

(Applicable to all Federal-aid contracts - 49 CFR 29)

- a. By signing and submitting this proposal, the prospective primary participant is providing the certification set out below.
- b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective primary participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.
- c. The certification in this clause is a material representation of fact upon which reliance was placed when the department or agency determined to enter into this transaction. If it is later determined that the prospective primary participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause of default.
- d. The prospective primary participant shall provide immediate written notice to the department or agency to whom this proposal is submitted if any time the prospective primary participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
- e. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the department or agency to which this proposal is submitted for assistance in obtaining a copy of those regulations.
- f. The prospective primary participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.
- g. The prospective primary participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," provided by the department or agency entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
- h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the nonprocurement portion of the "Lists of Parties Excluded From Federal Procurement or Nonprocurement Programs" (Nonprocurement List) which is compiled by the General Services Administration.
- i. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

- j. Except for transactions authorized under paragraph f of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion — Primary Covered Transactions

1. The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:
 - a. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
 - b. Have not within a 3-year period preceding this proposal been convicted of or had a civil judgement rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
 - c. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph 1b of this certification; and
 - d. Have not within a 3-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.
2. Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

2. Instructions for Certification - Lower Tier Covered Transactions:

(Applicable to all subcontracts, purchase orders and other lower tier transactions of \$25,000 or more - 49 CFR 29)

- a. By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.
- b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.
- c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.
- d. The terms "covered transaction," "debarred," "suspended," "ineligible," "primary covered transaction," "participant," "person," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.
- e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.
- f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

- g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Nonprocurement List.
- h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
- i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion — Lower Tier Covered Transactions

- 1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.
- 2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

XII. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

(Applicable to all Federal-aid construction contracts and to all related subcontracts which exceed \$100,000 - 49 CFR 20)

- 1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:
 - a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
 - b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- 2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.
- 3. The prospective participant also agrees by submitting his or her bid or proposal that he or she shall require that the language of this certification be included in all lower tier subcontracts, which exceed \$100,000 and that all such recipients shall certify and disclose accordingly.

FEDERAL-AID FEMALE AND MINORITY GOALS

In accordance with Section II, "Nondiscrimination," of "Required Contract Provisions Federal-aid Construction Contracts" the following are the goals for female utilization:

Goal for Women (applies nationwide).....(percent)	6.9
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The following are goals for minority utilization:

CALIFORNIA ECONOMIC AREA

		Goal (Percent)
174	Redding, CA:	
	Non-SMSA Counties	6.8
	CA Lassen; CA Modoc; CA Plumas; CA Shasta; CA Siskiyou; CA Tehama.	
175	Eureka, CA	
	Non-SMSA Counties	6.6
	CA Del Norte; CA Humboldt; CA Trinity.	
176	San Francisco-Oakland-San Jose, CA:	
	SMSA Counties:	
	7120 Salinas-Seaside-Monterey, CA	28.9
	CA Monterey.	
	7360 San Francisco-Oakland	25.6
	CA Alameda; CA Contra Costa; CA Marin; CA San Francisco; CA San Mateo.	
	7400 San Jose, CA	19.6
	CA Santa Clara.	
	7485 Santa Cruz, CA.	14.9
	CA Santa Cruz.	
	7500 Santa Rosa, CA	9.1
	CA Sonoma.	
	8720 Vallejo-Fairfield- Napa, CA	17.1
	CA Napa; CA Solano	
	Non-SMSA Counties	23.2
	CA Lake; CA Mendocino; CA San Benito	
177	Sacramento, CA:	
	SMSA Counties:	
	6920 Sacramento, CA	16.1
	CA Placer; CA Sacramento; CA Yolo.	
	Non-SMSA Counties	14.3
	CA Butte; CA Colusa; CA El Dorado; CA Glenn; CA Nevada; CA Sierra; CA Sutter; CA Yuba.	
178	Stockton-Modesto, CA:	
	SMSA Counties:	
	5170 Modesto, CA	12.3
	CA Stanislaus.	
	8120 Stockton, CA	24.3
	CA San Joaquin.	
	Non-SMSA Counties	19.8
	CA Alpine; CA Amador; CA Calaveras; CA Mariposa; CA Merced; CA Tuolumne.	

		Goal (Percent)
179	Fresno-Bakersfield, CA	
	SMSA Counties:	
	0680 Bakersfield, CA	19.1
	CA Kern.	
	2840 Fresno, CA	26.1
	CA Fresno.	
	Non-SMSA Counties	23.6
	CA Kings; CA Madera; CA Tulare.	
180	Los Angeles, CA:	
	SMSA Counties:	
	0360 Anaheim-Santa Ana-Garden Grove, CA	11.9
	CA Orange.	
	4480 Los Angeles-Long Beach, CA	28.3
	CA Los Angeles.	
	6000 Oxnard-Simi Valley-Ventura, CA	21.5
	CA Ventura.	
	6780 Riverside-San Bernardino-Ontario, CA.	19.0
	CA Riverside; CA San Bernardino.	
	7480 Santa Barbara-Santa Maria-Lompoc, CA	19.7
	CA Santa Barbara.	
	Non-SMSA Counties	24.6
	CA Inyo; CA Mono; CA San Luis Obispo.	
181	San Diego, CA:	
	SMSA Counties	
	7320 San Diego, CA.	16.9
	CA San Diego.	
	Non-SMSA Counties	18.2
	CA Imperial.	

In addition to the reporting requirements set forth elsewhere in this contract the Contractor and subcontractors holding subcontracts, not including material suppliers, of \$10,000 or more, shall submit for every month of July during which work is performed, employment data as contained under Form FHWA PR-1391 (Appendix C to 23 CFR, Part 230), and in accordance with the instructions included thereon.